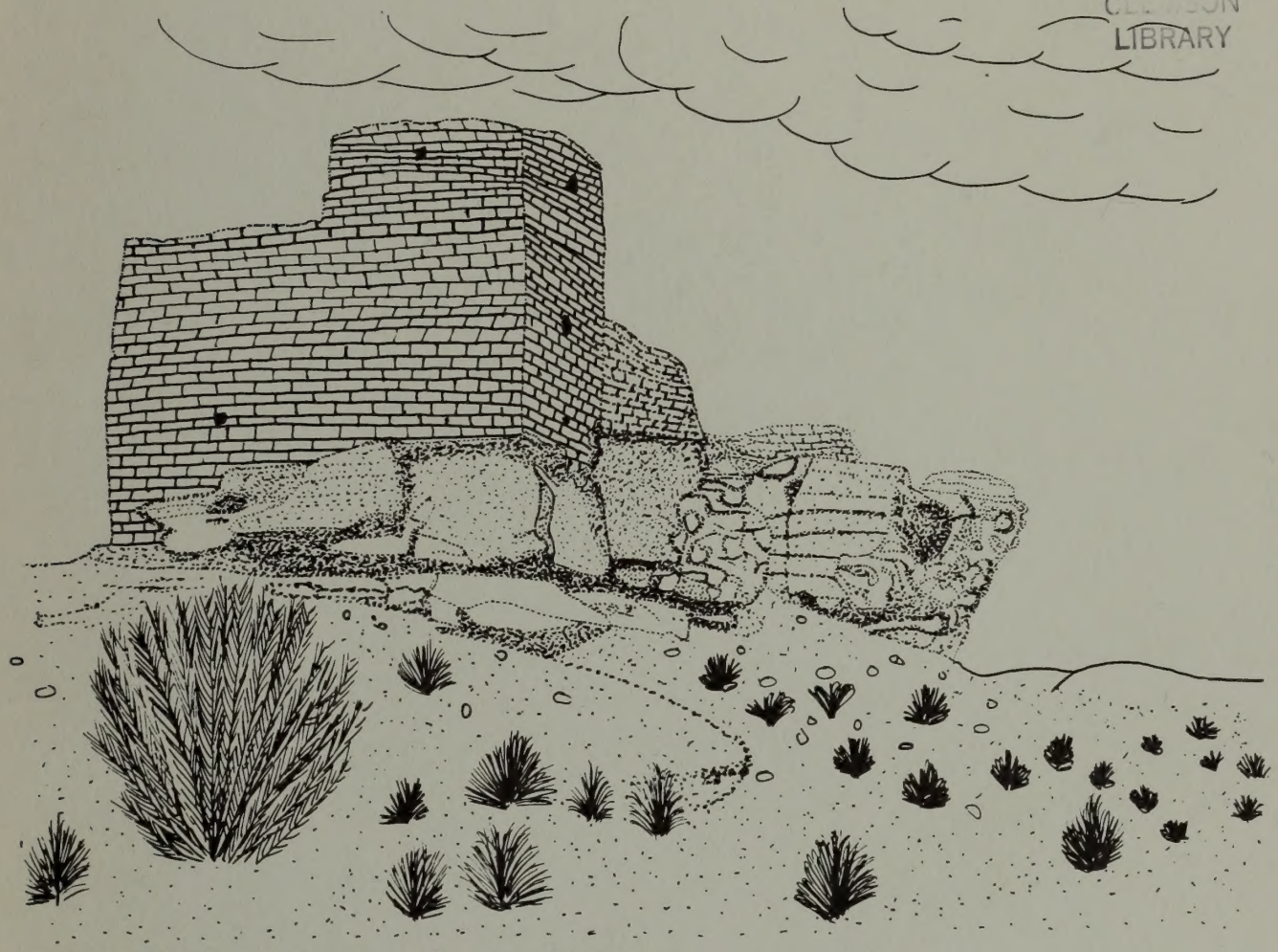
I 29.116:35
The Wupatki Archeological I...

...ki Archeological Inventory Survey Project: Final Report

Clemson University
3 1604 019 699 638

PUBLIC ...ENTS
DEPO... ...EM
JAN 3 0 1991
CLEMSON
LIBRARY



Compiled by Bruce A. Anderson

Southwest Regional Office, Division ... Anthroplogy
Southwest Cultural Resources Center,
Professional Paper No. 35

As the nation's principal conservation agency, the Department of the Interior has responsibility for most of our nationally owned public lands and natural and cultural resources. This includes fostering wise use of our land and water resources, protecting our fish and wildlife, preserving the environmental and cultural values of our national parks and historical places, and providing for the enjoyment of life through outdoor recreation. The department assesses our energy and mineral reosurces and works to ensure that their development is in the best interests of all our people. The department also promotes the goals of the Take Pride in America campaign by encouraging stewardship and citizen responsibility for the public lands and promoting citizen participation in their care. The department also has a major responsibility for American Indian reservation communities and for people who live in island territories under U.S. administration.

THE WUPATKI ARCHEOLOGICAL INVENTORY SURVEY PROJECT: FINAL REPORT

Bruce A. Anderson

Division Of Anthropology
National Park Service
Santa Fe, New Mexico

Southwest Cultural Resources Center
Professional Paper No. 35
1990

TABLE OF CONTENTS

LIST OF FIGURES vii

LIST OF TABLES xv

PREFACE xix

ACKNOWLEDGEMENTS xxi

CHAPTER 1, BACKGROUND

Bruce A. Anderson
- Background and Purpose 1-1
- Methodology 1-5
- Research Perspectives 1-9
- Other Activities 1-14

CHAPTER 2, SITE TYPES AND CULTURAL PERSPECTIVES

Bruce A. Anderson
- Previous Work 2-1
- Listing of Sites 2-2
- Site Types and Variations 2-3
- Discussion 2-23

CHAPTER 3, ENVIRONMENT

Bruce A. Anderson
- Overview 3-1
- Geology 3-1
- Soils 3-7
- Climate 3-10

Hydrology 3-12
Flora 3-14
Fauna 3-28
Conclusion 3-38

CHAPTER 4, PREHISTORIC AGRICULTURAL LANDSCAPE

Scott E. Travis
Introduction, Objectives, and Organizing Principles 4-1
Environmental Context 4-7
Settlement Context 4-8
Archeology of the Prehistoric Agricultural Landscape 4-9
Field Elements 4-10
Field Systems 4-13
Field Structures 4-27
The Agricultural Landscape: Geography and Ecology 4-32
Land Classification Units 4-42
Underlying Geological Features 4-42
Soil Zones 4-44
Contemporary Vegetation 4-47
Precipitation and Hydrology 4-49
Temperature and Wind 4-50
Agricultural Decision Making and Ecology: The Microlandscape 4-50
Evolution of the Agricultural Landscape 4-52
Conclusions 4-54

CHAPTER 5, SETTLEMENT PATTERNS

Christian E. Downum and Alan P. Sullivan, III
Introduction 5-1
The Data Base 5-2
Chronology 5-10
Descriptive Summary of Site Types and Site Characteristicss 5-16
Summary and Conclusions 5-40
A Preliminary Consideration of Undecorated Ceramic Assemblages 5-41
A Functional Typology of Wupatki Sites 5-57
Population Levels 5-68
Synthesis and Research Recommendations 5-82
Management Recommendations 5-89

CHAPTER 6, ETHNO-HISTORY AND ARCHEOLOGY

Alexandra Roberts
Introduction 6-1
Methods and Procedures 6-3
Previous Research 6-5
Changes in Navajo Land Use 6-24
An Inventory of Wupatki's Historic Archeological Record 6-35

Recommendations for Management and Future Research 6-84
Conclusion 6-94

CHAPTER 7, MATERIAL CULTURE PERSPECTIVES

Bruce A. Anderson and Stan A. McDonald
Shell 7-2
Glass 7-7
Metal 7-9
Other Objects 7-13
Ground, Smoothed, and Flaked Stone 7-17
Flaked Lithic Artifacts 7-28
Artifacts 7-32
Debitage 7-56
Summary and Conclusions 7-61

CHAPTER 8, CERAMICS

Michael B. Stanislawski
Data 8-2
Method and Problems of Analysis 8-2
Typology and Classification 8-20
Ceramic Artifacts 8-33
Analysis of Data 8-33
Ceramic Temporal and Cultural Periods 8-33
Comparison of Percentages of Pottery from Excavated and Surveyed Sites 8-45
Percentages of Counts and Weights Compared 8-46
Conclusions 8-47

CHAPTER 9, ROCK ART

Bruce A. Anderson
Background 9-1
Zoomorphs 9-15
Anthropomorphs 9-21
Geometrics 9-25

CHAPTER 10, CONCLUSION

Bruce A. Anderson
The Data Base 10-1
Recapping the Volume and the Project 10-2
Interpretative Changes 10-5
Future Outlook 10-6

BIBLIOGRAPHY 11-1

LIST OF FIGURES

1.1	Map of Wupatki National Monument	1-2
1.2	Research Strategy	1-4
1.3	The 1982 Crew Photo	1-6
1.4	Survey Phases	1-10
1.5	Stylized Drawing	1-11
2.1	WS1378, Pithouse	2-3
2.2	WS1525, Basalt Pueblo	2-5
2.3	WS1395, Sandstone Pueblo	2-5
2.4	WS323 (NA637)	2-6
2.5	WS1802 , Rock Art Panel	2-7
2.6	WS1556, Petroglyphs	2-8
2.7	WS1848, Hogan Complex	2-8
2.8	WS2303, Hogan	2-8
2.9	WS1945, Corral	2-9
2.10	WS1526, Sweat Lodge	2-11
2.11	WS1526, Sweat Lodge	2-11
2.12	WS1429, Ramada	2-11
2.13	WS1953, Rock Shelter	2-12
2.14	WS1914, Rock Shelter	2-13
2.15	WS2027, Rock Shelter	2-13
2.16	WS1763, Cairn	2-14
2.17	WS165, Dam and Reservoir	2-14
2.18	WS1730, Fieldhouse	2-15
2.19	WS522, Fieldhouse	2-16
2.20	WS1489, Shrine	2-16
2.21	WS833, Kiva	2-17
2.22	WS1434, Kiva	2-17
2.23	WS1814, Quarry	2-19

2.24 WS1787, Quarry 2-20
2.25 WS886, Enclosure and Fieldhouse 2-20
2.26 WS1177, Enclosure 2-21
2.27 WS1603, Earth Crack 2-21
2.28 WS1720, Field System 2-22
2.29 WS1316, Community Room 2-23
2.30 WS249, Standing Wall 2-25

3.1 Generalized Geologic Map for Wupatki 3-3
3.2 Geologic Column Cross-Section 3-4
3.3 WS1226, Blowhole 3-4
3.4 Wupatki Soil Zones 3-9
3.5 WS907, Alignments 3-10
3.6 Antelope Prairie 3-10
3.7 The Wupatki Basin 3-10
3.8 Dendrochronology Sampling 3-12
3.9 Wupatki Vegetation Zones 3-25
3.10 Overview of Wupatki to the East 3-38

4.1 Agricultural Fields Sample 4-14
4.2 Field System 23 4-18
4.3 Field System 6 4-19
4.4 Field System 17 4-20
4.5 Field System 22 4-21
4.6 Field System 27 4-21
4.7 Field System 32 4-22
4.8 Field System 26 4-22
4.9 Field System 5 4-23
4.10 Field System 2 4-24
4.11 Field System 20 4-24
4.12 Terrace Garden 4-25
4.13 Terrace Garden 4-26
4.14 Terrace Field 4-27
4.15 Geographical Placenames 4-34
4.16 Frequency Distribution-Agricutural Features 4-35
4.17 Frequency Distribution-Field Structures 4-36
4.18 Distribution-Multi-room Field Structures 4-37
4.19 Land Classification Units 4-43
4.20 Soil Zones 4-48

5.1 Wupatki Period 1 Sites 5-13
5.2 Wupatki Period 2 Sites 5-14
5.3 Wupatki Period 3 Sites 5-14
5.4 Wupatki Period 4 Sites 5-15
5.5 Wupatki Period 5 Sites 5-15
5.6 Wupatki, All Prehistoric Sites (n = 2397) 5-16

5.7 Wupatki Artifact Scatters (Site Type = 1) 5-19
5.8 Wupatki Agricultural Sites 5-20
5.9 Wupatki Reservoir Sites 5-21
5.10 Wupatki Cist Sites 5-21
5.11 Wupatki Quarry Sites 5-22
5.12 Wupatki Shrine Sites 5-23
5.13 Wupatki Petroglyph Sites and Localities 5-24
5.14 Wupatki Burial Sites 5-24
5.15 Wupatki Multiple Story Pueblos 5-27
5.16 Wupatki Enclosure Sites 5-30
5.17 Wupatki Isolated Masonry Rooms 5-32
5.18 Wupatki Isolated Pit Structures 5-34
5.19 Wupatki Sites with Multiple Pit Structures, No Masonry Rooms 5-35
5.20 Wupatki sites with 2-6 Architectural Spaces 5-37
5.21 Wupatki Distribution of Sites with 6 Architectural Spaces 5-40
5.22 Histogram of Tusayan Gray Ware Percentages 5-43
5.23 Wupatki Sites with 50% Tusayan Gray Ware 5-44
5.24 Wupatki Sites with 75% Tusayan Gray Ware 5-44
5.25 Histogram of Alameda Brown Ware Percentages 5-45
5.26 Wupatki Sites with 50% Alameda Brown Ware 5-46
5.27 Wupatki Sites with 75% Alameda Brown Ware 5-46
5.28 Histogram of San Francisco Mountain Ware Percentages 5-47
5.29 Wupatki Sites with 50% San Francisco Mountain Gray Ware 5-47
5.30 Wupatki Sites with 75% San Francisco Mountain Gray Ware 5-48
5.31 Histogram of Prescott Gray Ware Percentages 5-48
5.32 Wupatki Sites with Mixed Ceramic Assemblages 5-50
5.33 Wupatki "Anasazi" Sites Identified by Cluster Analysis 5-54
5.34 Wupatki "Sinagua" Sites Identified by Cluster Analysis 5-54
5.35 Wupatki "Cohonina" Sites Identified by Cluster Analysis 5-55
5.36 Wupatki "Anasazi/Sinagua" Sites Identified by Cluster Analysis 5-55
5.37 Wupatki "Cohonina/Anasazi" Sites Identified by Cluster Analysis 5.56
5.38 Wupatki Functional Code = 1, Period 2 5-73
5.39 Wupatki Functional Code = 1, Period 3 5-74
5.40 Wupatki Functional Code = 1, Period 4 5-74
5.41 Wupatki Functional Code = 1, Period 5 5-75
5.42 Wupatki Functional Code = 2, Period 2 5-75
5.43 Wupatki Functional Code = 2, Period 3 5-76
5.44 Wupatki Functional Code = 2, Period 4 5-76
5.45 Wupatki Functional Code = 2, Period 5 5-77
5.46 Wupatki Sites with Functional Code 1 5-77
5.47 Wupatki Sites with Functional Code 2 5-78

6.1 Regional Context of Wupatki 6-8
6.2 Major Geographic Features 6-9
6.3 Grandmother and Grandfather Peshlakai 6-15

6.4 1935 Christmas Party 6-17
6.5 Clyde Peshlakai 6-20
6.6 Locations of Fort Sumner Era Navajo Sites 6-27
6.7 Pre-Fort Sumner Site, WS 1586 6-28
6.8 Locations of Residences Occupied circa 1880-1930 6-29
6.9 Locations of Residences Occupied circa 1930-1940s 6-32
6.10 Family Use Areas, circa 1950-1964 6-34
6.11 Locations of Navajo Use, circa 1964-1979 6-36
6.12 WS1815 6-38
6.13 "Hopi House" 6-39
6.14 WS1848 6-40
6.15 WS816 6-41
6.16 WS2293 6-42
6.17 WS1028 6-43
6.18 WS767 6-44
6.19 Unnumbered Site 6-45
6.20 WS766 6-46
6.21 Distribution of Navajo Residential Sites 6-47
6.22 Distribution of Isolated Sweat Lodges 6-47
6.23 Deadman's Wash used as Horse Corral 6-66
6.24 Distribution of Temporary Camps 6-67
6.25 Distribution of Isolated Livestock Management Facilities 6-67
6.26 Distribution of Isolated Water Control Facilities 6-68
6.27 Distribution of Isolated Historic Dumps 6-68
6.28 Distribution of Historic Petroglyphs 6-69
6.29 Black Falls Trading Post 6-69
6.30 Distribution of Sites Related to Black Crossing 6-76
6.31 Distribution of Historic Sites of Unknown Function 6-76
6.32 All Historic Sites 6-83

7.1 WUPA3842, Shell Bracelet Fragment 7-4
7.2 WUPA3844, Shell Bracelet Fragment 7-4
7.3 WUPA3841, Shell Pendant 7-4
7.4 WUPA3840, Shell Bead 7-4
7.5 WUPA3884, Clear Glass Bottle 7-8
7.6 WUPA1952, Clear Glass Bottle 7-8
7.7 WUPA3875, Green Glass Bottle 7-8
7.8 WUPA4056, Blue Glass Bottle 7-8
7.9 WUPA3525, Ceramic Figurine 7-9
7.10 WUPA4070, Metal Bell 7-11
7.11 WUPA4069, Blacksmith's Forceps 7-12
7.12 WUPA4067, Cut Metal Cowboy 7-12
7.13 WUPA4073, Tin Drinking Cup 7-12
7.14 WUPA4074, Cut Metal Eagle 7-13
7.15 WUPA1893, .45 Cal. Pistol 7-13

7.16	WUPA3846, Trade Bead	7-15
7.17	WUPA3871, Pendant Fragment	7-15
7.18	WUPA2240, Pendant	7-15
7.19	WUPA3843, Pendant Fragment	7-15
7.20	WUPA3845, Pendant Fragment	7-15
7.21	WUPA2432, Prehistoric Basket	7-15
7.22	WUPA2434, Mining Claim	7-16
7.23	WUPA4102, 3/4 Grooved Axe	7-24
7.24	WUPA4089, Basalt Cylinder	7-24
7.25	WUPA4104, Basalt Plug	7-24
7.26	WUPA4123, Basalt Effigy	7-24
7.27	WUPA4108, Sandstone Disk	7-25
7.28	WUPA4118, 2 Handed Mano	7-25
7.29	WUPA4112, 2-Handed Mano	7-25
7.30	WUPA4114, 2-Handed Mano	7-25
7.31	WUPA4117, Complete Hoe	7-26
7.32	WUPA4154, Basalt Stone Bowl	7-26
7.33	WUPA4133, Complete Hoe	7-26
7.34	WUPA4163, Basalt Grinding Stone	7-26
7.35	WUPA4169, Complete Mano	7-27
7.36	WUPA4156, Basalt Mano	7-27
7.37	WUPA4174, Basalt Mano	7-27
7.38	WUPA4177, Trough Metate	7-27
7.39	WUPA4178, Trough Metate	7-28
7.40	WUPA4160, Grooved Axe or Maul Fragment	7-28
7.41	Type 1 Projectile Points	7-40
7.42	Types 2, 3, 4, and 5 Projectile Points	7-42
7.43	Types 6 and 7 Projectile Points	7-44
7.44	Types 7 and 8 Projectile Points	7-45
7.45	Types 9 and 10 Projectile Points	7-47
7.46	Stage I-III Bifaces	7-50
7.47	Stage IV Bifaces	7-51
7.48	Specialized Bifaces	7-54
7.49	Gravers and Unifaces	7-55
7.50	Flaked Lithic Cores	7-57
7.51	Clovis Point	7-59
8.1	Tusayan Gray Ware	8-22
8.2	Other Wares	8-25
8.3	Tusayan White Ware	8-27
8.4	Tusayan White Ware	8-28
8.5	Tusayan White Ware	8-29
8.6	Little Colorado White Ware	8-30
8.7	Tsegi Orange Ware	8-31
8.8	Tsegi Orange Ware	8-32

8.9 Complete Vessels 8-34
8.10 Complete Bowl 8-35
8.11 Restored Vessel 8-36
8.12 Worked Sherds 8-36
8.13 Ceramic Handles 8-37

9.1 WS834, Panel 30, Anthropomorph 9-1
9.2 Map of Distribution of Rock Art Sites 9-3
9.3 WS835, Panel 4, Antelope 9-3
9.4 WS775, Panel 1, Recording Rock Art Sites 9-4
9.5 WS831, Panel 2, Bird 9-4
9.6 WS1802, Panel 1, Recording Rock Art 9-5
9.7 WS1107, Panel 1, Spiral 9-5
9.8 WS1290, Stylized Lizard 9-6
9.9 WS831, Panel 13, Group of Figures 9-6
9.10 WS2056, Panel R, Pictograph 9-7
9.11 WS2056, Panel G, Stylized Swastika 9-7
9.12 WS81, Bighorn Sheep 9-7
9.13 WS1769, Navajo Rock Art 9-8
9.14 WS1770, Horse and Mesa 9-8
9.15 WS1688, Panel 3, Grouping of Element 9-9
9.16 WS1243, Panel 1, Horned Kokopelli 9-9
9.17 WS1739, Panel B, Anthropomorph 9-9
9.18 WS380, Panel 1, Elements Pecked into Limestone 9-10
9.19 WS1445, Petroglyph 2, Snake 9-10
9.20 WS1763, Anthropomorph 9-11
9.21 WS1636, Panels 3 & 4, Petroglyphs 9-11
9.22 WS1177, Panel 1, Geometric Designs 9-12
9.23 WS834, Panel 2, Textile Design 9-12
9.24 WS834, Panel 72, Outlined Cross 9-13
9.25 WS334, Panel 30, Joined Bighorn Sheep 9-13
9.26 WS2176, Panel A, Stylized Bird 9-14
9.27 WS834, Panel 9, Stylized Lizard 9-14
9.28 WS155, Dog or Coyote 9-15
9.29 WS1747, Panel 2, Bighorn Sheep 9-15
9.30 WS833, Panel 11, Two Kokopellis 9-16
9.31 WS833, Panel 2, Hunting Scene 9-16
9.32 WS1445, Petrogyph I, Spiral 9-17
9.33 WS833, Panel 17, Dog or Coyote 9-17
9.34 WS833, Panel 8, Mountain Lion 9-17
9.35 WS834, Panel 39, "Fat" Lizards 9-18
9.36 WS833, Panel 1, Birds and Animal 9-18
9.37 WS833, Panel 18, "The Dragon" 9-19
9.38 WS834, Panel 72, Combination of Elements 9-19
9.39 WS1460, Spiral Snake 9-20

9.40	WS833, Panel 18, "The Dragon"	9-20
9.41	WS834, Panel 20, Navajo Horse	9-21
9.42	WS1634, Anthropomorph	9-21
9.43	WS160, Petroglyph 12, Human Feet	9-21
9.44	WS834, Panel 20, Scratched Horse	9-22
9.45	WS1739, Panel B, Several Elements	9-22
9.46	WS1654, Panel 2, Horned Toad	9-23
9.47	WS834, Panel 70, Dog or Coyote	9-23
9.48	WS2039, Panel B, Complex Design	9-23
9.49	WS831, Panel 3A, Inter-connected Elements	9-24
9.50	WS834, Panel 41, Combination of Elements	9-24
9.51	WS160, Petrogyph 2, A Hopi Design	9-25
9.52	WS660, Geometric Design	9-25
9.53	WS834, Panel 3, Geometric Design	9-26
9.54	WS161, Panel 8, Open Geometric Design	9-26
9.55	WS834, Panel 4, Geometric Designs	9-27
9.56	WS834, Panel 41, Row of Figures	9-27
9.57	WS1808, Panel 3, Realistic Lizard	9-27
9.58	WS839, Panel 3, Geometic Design	9-28
9.59	WS839, Panel 1, Geometric Design	9-28
9.60	WS160, Petroglyph 10, Geometric Design	9-29
9.61	WS834, Panel 52, Spiral with Birds	9-29
9.62	WS1645, Geometric Design	9-29
9.63	WS1071, Panel 5, Enclosed Crosses	9-30
9.64	WS833, Panel 13, Middle Mesa "Sun-spiral"	9-30
9.65	WS1815, Panel 4, Historic Name and Date	9-31
9.66	WS2303, Panel 3, Historic Name	9-31
9.67	WS1660, Panel C, Figure with Dates	9-32
9.68	WS2309, Panel 1, Navajo Portrait	9-32
9.69	WS653, Panel B, Navajo Rock Art	9-33

LIST OF TABLES

1.1	Field Crew Members	1-5
1.2	Volunteers	1-6
1.3	Archeological History of Wupatki	1-11
2.1	Site Types	2-4
3.1	Plants Which had Cultural Use	3-16
3.2	Excavated Sites which have Listed Faunal Remains	3-30
3.3	Avifauna from Excavated Sites	3-34
4.1	Summary of Field System Sample	4-15
4.2	Soil Types and Characteristics	4-45
5.1	MNA Sites Used to Supplement Wupatki Data	5-9
5.2	Results of Ceramic Group Dating	5-13
5.3	Artifact Frequency Data for Site Types 1-8	5-17
5.4	Representation of Artifact Classes at Site Types 1-8	5-18
5.5	Periods of Occupation or Use for Site Types 1-8	5-18
5.6	Frequency of Architectural Spaces	5-20
5.7	Number of Depressions, by Number of Masonry Rooms	5-26
5.8	Architectural Data for all Sites with Architecture	5-26
5.9	Artifact Frequency Data for all Sites With Architecture	5-27
5.10	Representation of Artifact Classes at all Sites with Architecture	5-27
5.11	Periods of Occupation or Use for all Sites with Architecture	5-28
5.12	Architectural Data for Enclosure Sites	5-29
5.13	Artifact Frequency Data for Enclosure Sites	5-29
5.14	Representation of Artifact Classes at Enclosure Sites	5-29
5.15	Periods of Occupation or Use for Enclosure Sites	5-29
5.16	Architectural Data for Isolated Masonry Room Sites	5-31
5.17	Artifact Frequency Data for Isolated Masonry Room Sites	5-31

5.18 Representation of Artifact Classes at Isolated Masonry Room Sites 5-31
5.19 Periods of Occupation or Use for Isolated Masonry Room Sites 5-32
5.20 Artifact Frequency Data for Isolated Pit-structure Sites 5-33
5.21 Representation of Artifact Classes at Isolated Pit-structure Sites 5-33
5.22 Periods of Occupation or Use for Isolated Pit-structure Sites. 5-33
5.23 Artifact Frequency Data for Sites with Multiple Pit-structures 5-33
5.24 Representation of Artifact Classes at Sites with Multiple Pit-structure 5-34
5.25 Periods of Occupation or Use for Sites with Multiple Pit-structures 5-35
5.26 Architectural Data for Sites with 2-6 Architectural Spaces 5-35
5.27 Artifact Frequency Data for Sites with 2-6 Architectural Spaces 5-36
5.28 Representation of Artifact Classes at Sites with 2-6 Spaces 5-36
5.29 Periods of Occupation or Use for Sites with 2-6 Spaces 5-36
5.30 Architectural Data for Sites with 7-10 Architectural Spaces 5-37
5.31 Artifact Frequency Data for Sites with 7-10 Architectural Spaces 5-37
5.32 Representation of Artifact Classes at Sites with 7-10 Spaces 5-38
5.33 Periods of Occupation or Use for Sites with 7-10 Spaces 5-38
5.34 Architectural Data for Site with 11-20 Architectural Spaces 5-38
5.35 Artifact Frequency Data for Sites with 11-20 Architectural Spaces 5-38
5.36 Representation of Artifact Classes at Sites with 11-20 Spaces 5-39
5.37 Periods of Occupation or Use for Sites with 11-20 Spaces 5-39
5.38 Architectural Data for Sites with 20 Architectual Spaces 5-39
5.39 Artifact Frequency Data for Sites with 20 Architectural Spaces 5-40
5.40 Representation of Artifact Classes at Sites with 20 Spaces 5-41
5.41 Periods of Occupation or Use for Sites with 20 Spaces 5-41
5.42 Attributes of Sites with "Mixed" Ceramic Assemblages 5-49
5.43 Final Cluster Centers for Cluster Analysis of Undecorated Ceramics 5-53
5.44 Final Cluster Centers and Number of Sites in Each Cluster 5-61
5.45 Breakdown of Cluster 1 Sites by Structures, Rooms, and Artifact Frequency 5-61
5.46 Periods of Occupation or Use for Cluster 1 Sites 5-61
5.47 Breakdown of Cluster 2 Sites by Structures, Rooms, and Artifact Frequency 5-62
5.48 Periods of Occupation or Use for Cluster 2 Sites 5-62
5.49 Breakdown of Cluster 3 Sites by Structures, Rooms, and Artifact Frequency 5-63
5.50 Periods of Occupation or Use for Cluster 3 Sites 5-63
5.51 Breakdown of Cluster 4 Sites by Structures, Rooms and Artifact Frequency 5-64
5.52 Periods of Occupation or Use for Cluster 4 Sites 5-64
5.53 Breakdown of Cluster 5 Sites by Structures, Rooms, and Artifact Frequency 5-65
5.54 Period of Occupation or Use for Cluster 5 Sites 5-65
5.55 Total Architectural Spaces, by Time Period, for Functional Code 1 Sites 5-70
5.56 Architectural Spaces/Total Periods, by Time Period, for F. Code 1 Sites 5-70
5.57 Architectural Spaces/Total Periods by Time Period, for F. Code 1 Sites 5-71
5.58 Architectural Spaces by Time Period, for F. Code 2 Sites 5-71
5.59 Time-Corrected Population Estimates for F. Code 1 Sites 5-72
5.60 Time-Corrected Population Estimates for F. Code 1 Sites 5-72
5.61 Time-Corrected Population Estimates for F. Code 2 Sites 5-72
5.62 Time-Corrected Population Estimates for F. Code 2 Sites 5-72

5.63 Tree-Ring Dates from Wupatki National Monument 5-79
5.64 Decade-by-Decade Breakdowns of Tree-Ring Dates 5-79
5.65 Totals of Selected Black-on White Types 5-80

6.1 Information Sources consulted during phase 1 6-3
6.2 Navajo and Livestock Populations in Wupatki between 1934 and1971 6-30
6.3 Locations and Historical Contexts of Navajo Residential Sites 6-48
6.4 Locations and Descriptions of Sweat Lodges 6-55
6.5 Locations and Descriptions of Temporary Campsites 6-57
6.6 Locations and Descriptions of Isolated Livestock Facilities 6-60
6.7 Locations and Descriptions of Historic Water-control Facilities 6-63
6.8 Locations and Descriptions of Isolated Historic Dumps 6-70
6.9 Locations and Descriptions of Historic Petroglyphs 6-71
6.10 Sites Associated with Black Falls Crossing 6-74
6.11 Site of Unknown Function 6-77
6.12 Locations and Descriptions of Miscellaneous Other Historic Sites 6-82
6.13 Partial Genealogy 6-94

7.1 Shell Bracelet Fragments 7-3
7.2 Other Shell Objects 7-5
7.3 Glass Objects 7-6
7.4 Metal Objects 7-9
7.5 Other Objects (Wood, Mineral, Plastic, Rubber, Paper Fiber, and Leather) 7-14
7.6 Ground, Flaked, and Smoothed Stone 7-18
7.7 Axes and Mauls: Additional Measurements 7-23
7.8 Summary, Description of Raw Material Types Represented in the Wupatki Debitage 7-31
7.9 Description and Attributes of Projectile Points 7-33
7.10 Summary and Description of Bifaces 7-52
7.11 Summary of Debitage by Raw Material Type 7-58
7.12 Technological Summary of Several Selected Sites 7-60

8.1 Wupatki Ceramic Survey 8-4
8.2 Ceramics From Excavated Sites 8-18
8.3 Excavated and Surveyed Sites Compared 8-19
8.4 Relative Time Periods for Certain Sites 8-39

9.1 Listing of Rock Art Sites 9-2

PREFACE

Wupatki Archeological Investigations

Some 90 years after Archeologist Jesse Walter Fewkes completed his first studies of the area now known as Wupatki National Monument, the Southwest Cultural Resources Center of the National Park Service is proud to publish this addition to its Professional Papers Series. The Professional Papers Series is designed to enhance public and academic understanding of the cultural resources contained within the units of the Southwest Region of the National Park Service.

Bruce Anderson's long-awaited analysis is the product of 7 field seasons of intensive survey work, covering nearly all of the Monument's 35,254 acres. Using information gathered by former anthropologists and employing methodologies embraced by modern archeologists, Anderson and his crews gathered information about prehistoric Indian use of this area of the Southwest desert. Their studies prove that this use was much more extensive than originally estimated as 2,668 sites were recorded during the survey. Analysis of the architectural and ceramic evidence at these sites, moreover, indicates that Wupatki was the scene of a rich blending of cultures. This kind of information will be invaluable to National Park Service interpreters as they assist visitors in understanding the evolution of human use of the Monument.

Modern residents have much to learn about the adaptations of these early inhabitants to the harsh environment of the desert Southwest. Anderson's work will help us understand their successes and failures. If we pay attention to what archeologists and anthropologists are discovering, we may find that modern technology is no substitute for the kind of land use ethic practiced by our Indian ancestors.

Rick Smith
Associate Regional Director
Resources Management
Southwest Region

ACKNOWLEDGEMENTS

From the very beginning of the Wupatki Project, there was a strong team effort, and it continued in that manner throughout. I would like to gratefully acknowledge all of the individuals who labored in the field, worked in the office, and supported the project to the end. The list of people who participated and assisted me during the project is lengthy; and all of their reponses were generous, and are deeply appreciated. A reverse order of occurrence will be utilized, with the manuscript production noted first, and the field-work listed last. Also, special acknowledgements are given for those individuals who assisted Chris Downum and Alan Sullivan on Chapter 5, Alexandra Roberts on Chapter 6, and Stan McDonald on Chapter 7.

The massive efforts of Jerry Livingston, Eileen A. Lopez, and Ernesto Martinez allowed me to complete this manuscript within a very short deadline. Without them, and their commitment to the production of this report, I would have been lost. Just the typing and retyping of this document, and the other reports associated with the project, required many long hours. For those who labored on these tasks, I would like to thank Margaret Blivens, Suzette Lopez, Patricia Sedillo, April C de Baca, Marie Free, Teresa Crumley, Charlotte Lehman, Sherry Ivey and Eileen A. Lopez. For the illustrations of artifacts, maps, and other graphics, my appreciation goes to Tara Travis, Ernesto Martinez, and Ron Brown. All of the others who generously assisted were: Bill Crowder and Jerry Livingston who photographed artifacts; Jerry Livingston who did all of the layout for the camera ready report; Sarah Nestor and Tom Ireland who did the editing; David Breternitz and Arthur Ireland who did peer review; Amalin Ferguson who provided library assistance; and Joan Mathien and Walter Wait who provided advice on the publishing procedures needed.

Christian E. Downum and Alan P. Sullivan, III provided the following acknowledgements: We want to thank Doug Gann, for entering much of the data; Walt Allen, for helping generate the maps; Bruce

Panowski, for expediting the transfer of data from NPS computers; and Denise Shay, for proofreading sections of the report. Finally, we owe special thanks to Michael B. Schiffer and the Laboratory of Traditional Technology at the University of Arizona. They gave us a home, an attitude, and a place to work, and we are grateful.

Alexandra Roberts provided the following acknowledgements: The project could not have been completed without the help of Henry Jones (former Superintendent), Wayne Landrum (Chief Ranger), and especially Steve Cinnamon (Resource Specialist), all of Wupatki National Monument. Steve shared time, interest and data, and never failed to find new sites. Susan Randolph, Management Assistant at Southwest Parks and Monuments Association, very professionally administered additional funding, without which oral histories could not have been collected. Many thanks go to all those who contributed immeasurable expertise, including Dr. Jeffrey S. Dean (University of Arizona), Dr. Klara B. Kelly (Navajo Nation Historic Preservation Department). Fred York (Ethnohistorical Consultant), David Brugge (National Park Service), Clarence Gorman (National Park Service), Dan Murphy (National Park Service), Sharon Debowski (Law Offices of Brown and Bain), Martha Blue (Ward and Blue, Attorneys), David Barrow (D.N.A.--Peoples Legal Services), Jim Babbitt (Babbitt Trading Company), Alan Downer (Navajo Nation Historic Preservation Department), Dr. Eric Henderson (House Minority Council, Arizona House of Representatives), Dr. Christian Downum (University of Arizona), Richard Begay (Northern Arizona University), Dr. Sarah Schlanger (University of Louisville) and especially John Stein (Bureau of Indian Affairs). Much gratitude also goes to those who shared their personal knowledge and memories of Wupatki: Dr. Robert Euler, Dr. Watson Smith, Katherine Bartlett, Albert Schroeder, Preston Mercer, Coytt Hackett and Harry Townsend. Special thanks to Sallie Brewer Harris, Mr. and Mrs. David Jones and Mr. and Mrs Phillip Van Cleve-- Wupatki's founding custodians and superintendents. They invited me into their homes, and helped me to understand the things that really matter. Most of all, thanks to Helen Davis, without whom I would never have heard the stories people had to tell. Helen served as interpreter, mentor and friend. I hope that my association with Helen and her family lasts long beyond this project. Finally my deepest appreciation to the Navajo people of Wupatki, past, present and future. This work is for you.

Stan A. McDonald provided the following acknowledgements: I would like to gratefully acknowledge Todd Metzger and Susan Chandler for their generous help with computer-assisted analyses. Thanks are extended to John Davis, who prepared artifact photographs, and to Kelle Mitchell and Dorothy Floyd, who typed the manuscript. I would also like to thank Paul Nickens for his advice and comments regarding this research project.

Once the field work was completed, a tremendous amount of effort was required to get the data together, do computer entries, archive materials, accession and catalogue artifacts to manage the information acquired. I would like to thank Rose Ortiz, Lourdes Lujan and Bruce Panowski who assisted with the computerized data entry; Judy Miles, Willow Roberts, Anthony Montano and Sophia Ulibarri who toiled with the archival documents (site forms, maps, notes, and photography); and to Louise Stiver, Kim McLean, Alice Benfer, Amy Halsband, Debbie King, Shirley Ortega and Barbara Stanislwski, I owe a spe-

cial debt of gratitude for their efforts involving the curation of the artifacts which were collected.

For overall project support, supervision, programming and direction special gratitude and thanks go to Calvin Cummings, Ron Ice, Larry Nordby, Charles Voll, Rick Smith and Douglas Scovill. For special funding assistance I would like to thank Douglas Scovill, Rick Smith, Virginia Robicheau and Dr. Milford Fletcher. For assistance with budgetry accounting, timekeeping responsibilities and personnel actions I want to thank Antoinette Curran and Sarah Chavez. For advice on stabilization activites at Wupatki, thanks goes to Todd Metzger. For assistance in the field from the Southwest Cultural Resources Center, special appreciation is given to James Bradford, Larry Nordby, Ron Ice, Peter McKenna and Louise Stiver. And Finally, for all the advice, support, and extra efforts I would like to thank all of the field crew members, and especially Steve Adams, Pat Stein, Dr. Chris Downum, Scott Travis and Dr. Dave Breternitz who were assistant field directors for the survey.

Last, but certainly not least, I would like to recognize the assistance of all of the park staff at Wupatki National Monument. I would especially like to thank Larry Henderson (Superintendent), Steve Cinnamon (Resource Management Specialist), Richard Aman (Maintenance Worker), Jane Dagenais, Jan Ryan and Trisha Crowley (all Park Rangers). Jan continued on with the project, by marrying the project director, and had to then devote much of her time toward the final goals of the project. For not being able to separate my personal life from my professional life, I am truly sorry.

I would like to dedicate this report to the memory of my friend and mentor, Dr. Robert H. Lister. His dedication, knowledge, and teaching provided me the background to see this project through.

Bruce A. Anderson
Supervisory Archeologist
Southwest Cultural Resources Center

Chapter 1

BACKGROUND

By Bruce A. Anderson

Wupatki National Monument, established in 1924, was set aside for its many archeological values. The first discussion of the cultural resources of the Wupatki area was provided by Lorenzo Sitgreaves, who reported on his 1851 military expedition down the Little Colorado River Valley. When the Wupatki Archeological Inventory Survey Project began, 130 years later, about 4,000 acres had been surveyed, and 12 sites had been excavated. Prior to this project, it was estimated that there were about 800 archeological sites within the boundaries of Wupatki, which encompasses 35,254 acres. Now that all of that land has been surveyed and inventoried, 2,668 sites have been documented; the total number is roughly 3 1/3 times greater than the previous estimate. Prior work did not provide extensive information on the various kinds of sites, the various cultures involved, and the range of environmental situations--all determinants of site density. Topographical variability, precipitation zones, vegetational zones, soil changes, and many other factors also contribute to the distribution of the sites used by those prehistoric agricultural peoples. In order to set the stage for the following chapters and to provide a starting place for this manuscript, some background is necessary. The purpose of this introductory chapter is to discuss the government's rationale for an inventory survey of the magnitude of the Wupatki Project, the archeological research accomplished in the area, and other activities conducted to meet the needs of the project and the park.

Background and Purpose

The National Park Service, after developing a General Management Plan and revising current interpretative programs, realized the need to establish a date base for the planning and management of Wupatki National Monument. It was also realized that the task directives for ac-

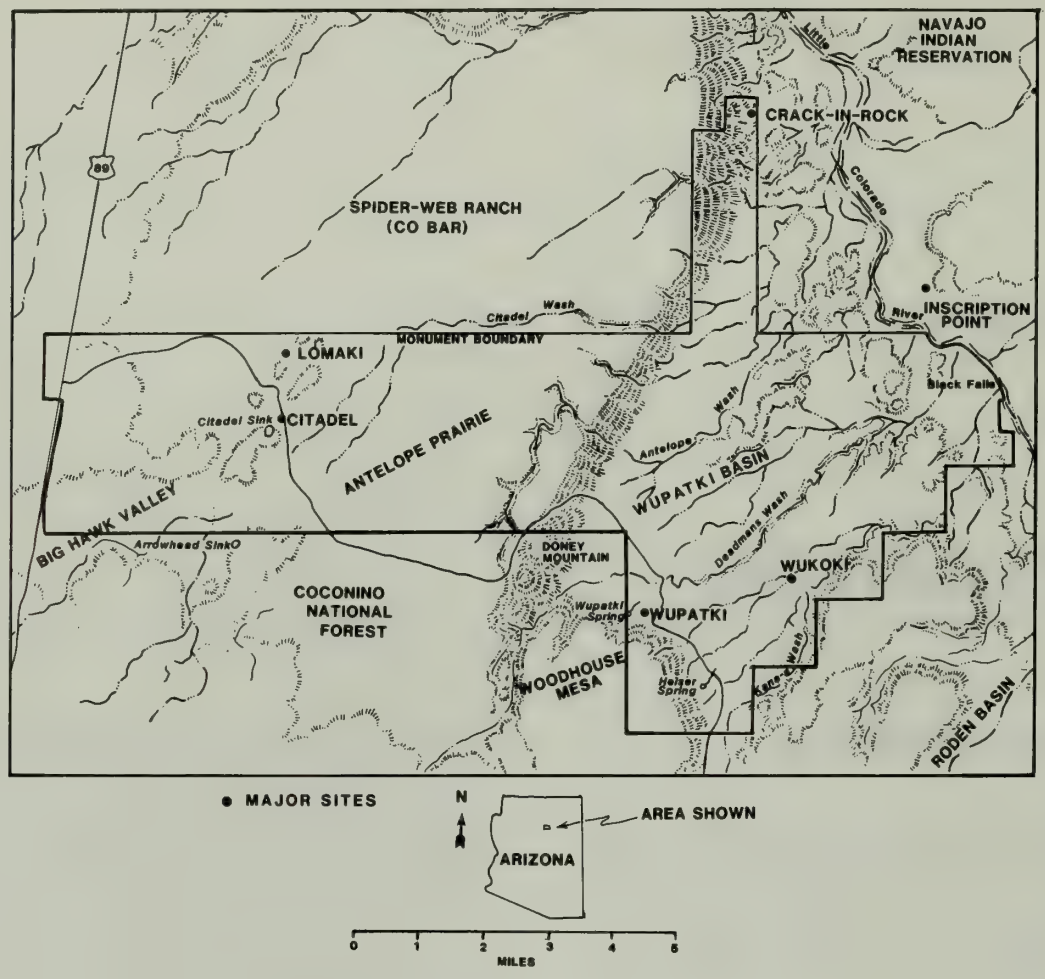


FIGURE 1.1 Wupatki National Monument.

complishing the work to be performed needed to be in accordance with the authorities of the Antiquities Act of 1906, the Historic Sites Act of 1935, the National Historic Preservation Act of 1966, Executive Order 11593, the Archeological Resources Protection Act of 1979, Public Law 96-515 (1980), NPS-28, and other approved policies and standards of the National Park Service. Thus the primary reasons for conducting the research were:

1. The National Park Service needed an inventory of its cultural resources within the park boundary to properly protect and manage those resources.

2. Prior to any proposed development within the park area, cultural resources needed to be evaluated for any impacts that might occur as a result of that development.

3. This additional data was necessary to properly evaluate the preservation and stabilization needs of the park.

4. With all of the background data at hand (remote sensing, an archeological assessment, vegetative studies, soil studies, etc.), it became

possible to finally approach an inventory evaluation.

5.To adequately interpret the total resources within the park, a survey of this nature was required.

In 1981 funding was made available to enhance the resource management programs for Wupatki National Monument and to conduct an archeological inventory within the Monument boundary. It was determined that the Southwest Cultural Resources Center in Santa Fe, New Mexico, would be responsible for conducting the fieldwork and reporting that work in accordance with accepted scientific standards. A scope-of-work and research design was prepared prior to beginning the project (Anderson 1981).

Many of my concerns about how the research would be conducted for this project were based on concerns previously illustrated by other professional archeologists as to how varying research needs involving survey methodology could be implemented. Some of these concerns included (1) the need for survey work; (2) site definition; (3) background research; (4) the level of intensity; (5) sampling; (6) collection strategies; (7) analysis; (8) multistage fieldwork; (9) recording procedures; (10) review procedures; and (11) an approach to the research that would create minimal impacts to the actual resources (Anderson 1981:6). A research design develops a rationale for the research, discusses how this research will be conducted, and provides a mechanism by means of which National Park Service managers, reviewers of the project, or other professional archeologists can evaluate what is being done (Anderson 1981:5).

The need for archaeological survey investigations is outlined in NPS-28 (1980:Chapter 5, 1-3), which calls for "studies, plans, and actions to accompany or precede park development, and to be part of a comprehensive planning sequence." An archaeological survey that is designed to extract all possible information from each site found during the intensive study of an area can provide more information than other types of survey (Ruppe 1966:313).

The rationale for an archeological survey of Wupatki National Monument is much the same as it was for the survey at Chaco Canyon. To make the survey as comprehensive as possible, it would need to (1) provide a tool for management; (2) gather information about population distribution and make some inferences about the people who lived there; and (3) approach gaps in our knowledge of the area (Hayes et al. 1980:1-2). Finally, with the increased demand for and emphasis on archeological survey, it becomes more important to document the decisions made in designing the survey (Plog et al. 1978:383-384).

The definition of an archeological site becomes an important basic consideration to any research approach. "A site is a discrete and potentially interpretable locus of cultural materials" (Plog et al. 1978:389). In the survey approach for Chaco Canyon, a "site" was considered as an area in which archeological evidence existed that was separated from another "site" (Hayes et al. 1980:16). Other investigators have talked about artifact density as a criterion for what constitutes a site, but I feel that the definitions given above allow for more judgment and flexibility in the field.

Almost everyone who has written about archeological surveys and survey research discusses the need for background research and background information prior to an in-

tensive survey project. Fortunately, the Wupatki area has been discussed in the literature for a number of years. The Archeological Assessment for Wupatki National Monument (Hartman and Wolf 1977); the numerous researchers presently working in the Flagstaff area (the Museum of Northern Arizona; the U.S. Forest Service, Coconino National Forest; the U.S. Geological Survey in Flagstaff; and Northern Arizona University); and all of the studies conducted on vegetation, soils, ground water, and remote sensing have established the background work for the area. This information was utilized to formulate the research directions for the Wupatki Archeological Inventory Survey Project.

The level of intensity for the survey was high by necessity, as this project was to be an inventory from the beginning. Intensity becomes a measure of what is covered and the effort it takes to survey the area (Schiffer and Gumerman 1977:184-185). Generally speaking, unless the intensity of any archaeological survey is high, there is a possibility of missing sites (Plog et al. 1978:393). A variety of factors can determine the level of intensity for any survey effort. These can include spacing of the crew members, logistics, vegetation, weather, capabilities of the individuals doing the work, terrain variations, and the nature of the observations recorded in the field (Schiffer and Gumerman 1977:186). All of these intensity factors will be discussed further in the methodology portion of this chapter, which will also include discussions on sampling, collection strategies, analysis, and recording procedures.

Multistaged fieldwork conducted in varying stages of intensity has been discussed by numerous authors writing about survey strategies (Judge 1979:1-9; King 1978:57; Plog et al. 1978:404; Schiffer and Gumerman 1977:188-189; Redman 1973:62-67). The design of the archeological survey for Wupatki National Monument adapts the multistage approach, and the flow chart (Figure 1.2) outlines the overall strategy for conducting the research. The

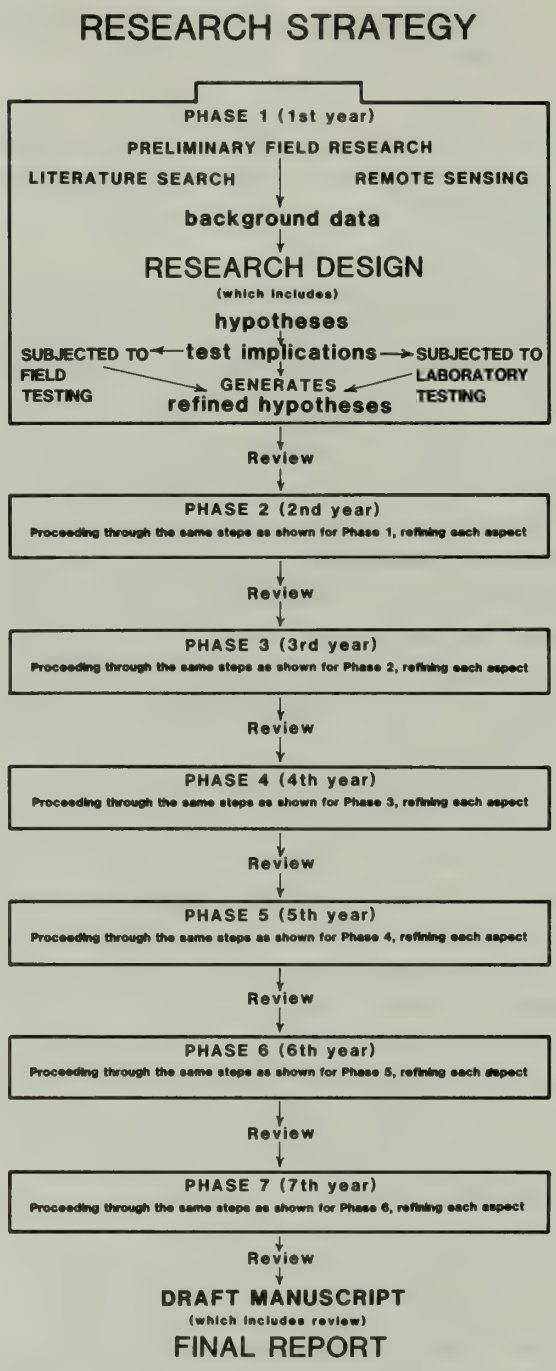


FIGURE 1.2. Research strategy.

key for the success of any multistage design is "feedback," in that each phase is dependent on the results of the preceding phase, resulting in a continual refinement of the overall design (Judge 1979:6). This approach was incorporated into the research design for the Wupatki Project to allow for continual refinement of the process throughout the duration of the fieldwork.

Reporting and review of the project was done several ways, and these included:

1. Annual review of the project by the Southwest Regional Office of the National Park Service and by four peer reviewers who agreed to act in that capacity (James Judge, Alexander J. Lindsay, George Gumerman, and Peter Pilles).

2. Informal review by the staff of the Southwest Cultural Resources Center, the Navajo Lands Group Office, and Wupatki National Monument staff for each phase of the project and throughout the year.

3. Articles for professional journals and formal presentations at professional meetings about the project constituted another mechanism for peer review.

4. Accountability and justifications involving the project were provided for the Washington Office of the National Park Service through all phases of the project.

The purpose of this extensive review process was to provide an opportunity for any professional input, allow for any major concerns, and redirect the research for the next phase if needed.

An attempt was made at the outset of the project to create a designed survey that would allow for minimal destruction of the cultural resources being investigated. An approach ethic, or a plea for conservation to be applied to archaeological inquiry was written in 1974 (Lipe 1974:213-245). Following this, there was a call for a "minimal impact" ethic to obtain the greatest amount of information for the least amount of archaeological resource destruction (Judge 1979:1). This approach, which helps to conserve and protect cultural resources, certainly was in keeping with National Park Service philosophies (Anderson 1981:9). By reducing the collection size from all the sites which were recorded, we accomplished one step toward this end. Not driving off the existing roadways was another. Finally, by gathering additional information on site condition and preservation needs, managers could better evaluate the steps needed to protect all the cultural resources.

Methodology

Crew size for the project varied over the years, from 6 in Phases I and VII up to 12 in Phase VI. All of the staff were selected on the basis of their previous experience doing archaeological survey work (many were graduate students in anthropology at the time). Throughout the fieldwork, 38 in-

TABLE 1.1. Field crew members.

1981:	Bruce Anderson, Steve Adams, Greg Welden, Sandy Rayl, Judy Miles, and Judy Swartz.
1982:	Bruce Anderson, Pat Stein, Anne Baldwin, Mike Bremer, Lauren Ritterbush, Chris Downum, Bill Cruetz, Roc Indermill, and Susan Larsen.
1983:	Bruce Anderson, Pat Stein, Anne Baldwin, Mike Bremer, Lauren Ritterbush, Bill Cruetz, Glenn Stone, Kim McLean, Joe Pearl, Teri Cleeland, and Gloria Judges.
1984:	Bruce Anderson, Chris Downum, Scott Travis, Jim Bayman, Joe Pearl, Peter Bungart, John Stein, Jane Whitmore, and Alexa Roberts.
1985:	Bruce Anderson, Scott Travis, Steve Germick, Dave Batten, Lisa LeCount, Warren Hurley, Patti Bell, Charles Hodges, and Alexa Roberts.
1986:	Bruce Anderson, Dave Breternitz, Scott Travis, Mark Hovezak, John Evaskovich, Barbara Murphy, Katherine Fuller, Dave Batten, Robert Emerson, Steve Germick, Elaine Zamora, and Warren Hurley.
1987:	Bruce Anderson, Dave Breternitz, John Evaskovich, Barbara Murphy, Robert Emerson, and Karen Wigglesworth.

dividuals, excluding myself, worked on the project and were paid crew members (Table 1.1). Additionally, throughout the project, there were a number of volunteers who worked with the field crew members on a short-term basis (Table 1.2). Several members of Wupatki National Monument staff (mainly seasonal interpreters) also worked with the field crews on a limited basis. Finally, Jim Bradford, Larry Nordby, and Ron Ice of the Division of Anthropology, Southwest Cultural Resources Center, all helped with the fieldwork. The dedication of all of these individuals made it possible to finish the fieldwork and to collect the amount of data that we did. Without their magnanimous efforts, this report could not exist.(Fig. 1.3)

In an attempt to develop project-specific information to prepare the research design for the inventory survey, several logistical factors needed to be considered. These were:

TABLE 1.2. Volunteers.

1981:	Connie Cinnamon and Amy Welden.
1982:	Peter Pilles.
1983:	Bob Gardner, Bruce Pendleton, Chris Downum, Linda Cole, Joan Svenonius, and NAU Field School.
1984:	Russell John and Denise Shay.
1985:	Russell John, Tara Travis, and Paul King.
1986:	Tina Dodd, William Butler, Carleton Jones, Louise Stiver, and NAU Field School.
1987:	Jenny Stonesifer.

1.Most of the area within the National Monument boundary was accessible in a reasonable time from where the crew would be staying, and the use of only one vehicle would be required. Such use would have the additional benefit of reducing costs.

2.Weather was generally fairly good over the summer months, with the exception of some afternoon rains in July and August.

3.Vegetation was reasonably sparse over most of the area, allowing for surface observation of cultural materials and features.

4.Most of the area was not of rugged terrain, although some steep washes, cliff faces, and mesas existed.

5.Previous records indicated that most of the sites were reasonably small and could be recorded utilizing only tapes and compasses (without taking specialized survey instruments into the field).

All of these logistical factors were utilized to determine crew size, vehicular needs, housing needs, equipment needs, safety considerations, and budgetary requirements for the project.

Another consideration, involving the intensity of the project, was locational controls for complete coverage of the area and

FIGURE 1.3. The 1982 crew photo.

for relocation of plotted sites. To ensure that features would definitely be observed by the crew members, spacing of the surveyors was kept between 5 and 10 meters apart. In order to keep the survey transects uniform (and to be able to locate features within those transects), a system of flagging was utilized throughout the survey process. Once a section of land (640 acres) had been selected for survey, its boundaries were defined by flagging after they had been located by chaining, compass bearings, and USGS survey markers. This defined the unit of land to be surveyed and formulated a section line boundary to be utilized for all phases of the project. On the initial survey sweep or transect down the section line, pin flags were set at periodic intervals (ca. every 50 meters) to indicate the outside perimeter of coverage. On the following return transect, that same individual would pick up the flag line, while the outside perimeter was being flagged by another person on the end of the survey crew. This process required everyone on the survey team to move uniformly down the transect in an even line and verified the total coverage of the area being surveyed. Also, as features were located within each transect, they were given a number, plotted on the transect map, and flagged to be recorded later. This methodology was adopted to allow for dense cultural materials, numerous agricultural features, and widely spaced features, and to enable the archeologists to combine these features into an overall meaningful site context (Anderson 1982:3).

Once the area was surveyed, all of the features that had been identified were reevaluated to formulate archaeological sites during the recording process. Each site was then plotted on a 7.5 minute USGS quadrangle map, a blown-up version of that map to double size, and 1:6,000 aerial photographs. The site was also recorded on a six-page form, which discussed general site information, location, condition, description, various site features, cultural activities, artifact assemblage, number of artifacts, collection methods, water resources, biotic environment, topography, geology, agricultural potential, resource potential, research potential, interpretive potential, site protection, preservation information, and what photographs were taken. A plan map (or maps) was drawn to scale for each recorded site. A permanent steel site stake was driven into each site, with the field number stamped into it, which also served as a reference point for any bearings to outlying features or artifacts and allowed for the relocation of that particular site at a later date. Along with the survey form and maps, a two-page computer form, a Museum of Northern Arizona site card, and a daily log were filled out by all of the crew members to further document each site. In many sections of Wupatki National Monument, isolated artifacts were recorded on a separate map and noted in addition to the site information (no special number or designation was given for isolated occurrences). All of the documents mentioned above were utilized in the preparation of this manuscript and became part of the total survey documentation (along with the collections, photographs, and administrative files on the project). This discussion of recording procedures is necessary for later reviewers to fully understand what was produced during the survey process (King 1978:58).

Collection strategies had been discussed widely in archeological literature prior to beginning the Wupatki Archeological Inventory Survey Project. Many professional archaeologists had argued for a no-collection policy, while others had presented justifiable reasons for controlled surface collections during the survey process:

> Rather than dichotomize survey techniques, it would seem better to recognize the destructive process for what it is and plan accordingly. This might involve controlled surface collection on a given sample of sites, non-collective survey with on-site analysis on a larger segment, and non-collective survey without artifact disturbance on the remainder, all accomplished in a multi-staged framework. In my view, then, whether or not to collect is not the important issue. The relevant question is when, where, what, and how much to collect in the interest of the immediate and long-range minimal impact on the archeological resource (Judge 1979:7).

I had initially planned that sample controlled collections would be taken from all sites during the early phases of the survey, with only limited collection and mostly on-site analysis during the middle phases, and finally, noncollection without artifact disturbance (but with documentation of types, numbers, and locations) in the last phases (Anderson 1981:8). Due to the limited amount of cultural materials associated with the many small sites recorded during the first phase, the collection strategy was changed in the field. Had this approach not been taken, the majority of the sites inventoried would have, by necessity, forfeited all of their surface cultural materials to provide a collection. Rather than surface collecting some of these sites out of existence, it was decided to take controlled samples only from sites where a proportionate sample could be obtained, obtain grab samples of certain unique or specialized items in particular cases, and primarily document the bulk of cultural materials in the field (Anderson 1982:9). This attempt was followed throughout the survey, and much smaller amounts of cultural materials were collected in the later phases. All told, artifacts were collected from 488 sites (approximately 18% of the total number of sites). Where controlled samples were collected, a transect was established through the trash area or along the main axis of the site, and artifacts were bagged in specific metric units. This allowed for comparisons across the site and comparisons with other sites. These transect units were also mapped and shown to scale on the overall plan map (Anderson 1981:8).

Initial analysis of all of the cultural materials collected was done in the field during the survey. All collected items were washed, labeled with the site number, and recorded on field specimen forms. At the end of the field season, all items collected during that phase were moved to Santa Fe and accessioned into a Regional collection for additional analysis. A running analysis can serve as a basis for planning and decision-making regarding the methodological steps taken in a field program (Binford 1964:440). This in-field analysis also allowed for the project members to become increasingly more familiar with the cultural materials of the area and helped to allow for a later no-collection strategy (Anderson 1981:8). All of the collections were then catalogued by the Regional curational staff, work that took approximately eight months to complete. This was necessary to allow for loans of selected materials to be further analyzed by individual contractors. The selected materials included most of the chipped stone and ceramics and will be discussed further in Chapters 7 and 8. Additionally, specialized treatment was required for some other items, discussed further in Chapter 7. All of the remaining analysis, measurements, observations, and comparisons were accomplished by the author. Most of the illustrations, however, were completed under contract to an illustrator and by illustrators in the office.

Before completing the discussion on methodology, a few comments need to be made on sampling. "Fieldwork must be conducted within the framework of a well-planned research design which provides for the application of probability sampling techniques at all levels of investigation" (Binford 1964:411). Generally, sampling is considered with survey approaches, where the funding available does not allow for 100% coverage or for inventory work (especially for large areas). For Wupatki National Monument, however, a complete inventory of the cultural resources was to be the final result of the project. Because the field research of this project was to be phased over seven years, it was decided to treat Phase 1 as a sample to develop predictions about the later phases and to develop additional insights about the effectiveness of sampling within a dense archeological area like Wupatki National Monument. That information was compared with the Chaco Canyon National Monument sample survey which was conducted prior to a total inventory for that monument (Judge et al. 1975). Once the inventory was completed for Wupatki (following Phase 7), it was compared with the Chaco total inventory (Hayes et al. 1980). The total area of Wupatki is slightly over 55 sections of land, and it seemed most rational to cover a single section at a time. This block approach was selected over a transect approach because it was a well-defined land management unit to deal with; also, if the funding for the later phases of the survey were eliminated, then the park would at least have an inventory for the sections that had been surveyed. In order to select the beginning areas to set up Phase 1, random numbers were computer-generated from the 58 total section numbers for Wupatki, and sections were then selected. Eleven sections (640 acres each) would comprised about 20% of the land mass, but in case the survey progressed faster than planned, additional sections were selected (Anderson 1981:7). This process was also utilized for the following phases of the project. Sampling was also utilized in the collection of the sites, which will be further discussed in Chapter 7. See Figure 1.4 for a map showing sampling for Phases 1-7.

Research Perspectives

The research designs for all of the phases of the project contained several questions which were to be addressed from the data collected throughout the course of the survey. Most of these questions dealt with (1) cultural use of the area; (2) settlement patterning; (3) relationships to geology and vulcanism; (4) agricultural usage; (5) water control; (6) resource exploitation; (7) rock art; (8) historic use of the area; and (9) modern developments. Before considering the strategies to approach these questions, it must be realized that there is always some degree of uncertainty in seeking solutions. Some of the uncertainty is inherent in the nature of the work; some is structural within the methodology; and some is the result of physical disturbance within the archeological record (Breternitz et al. 1978:Appendix 3, page 3). Realizing the above limitations, several approaches were considered beyond the collection of information, discussed in the methodology section. Several additional ways of looking at the material collected, combined with other available information, helped to clarify thinking about cultural process and to better address these research questions. Equally, all of the data collected over the years, utilizing the research strategy being described here, formulated the basis for this

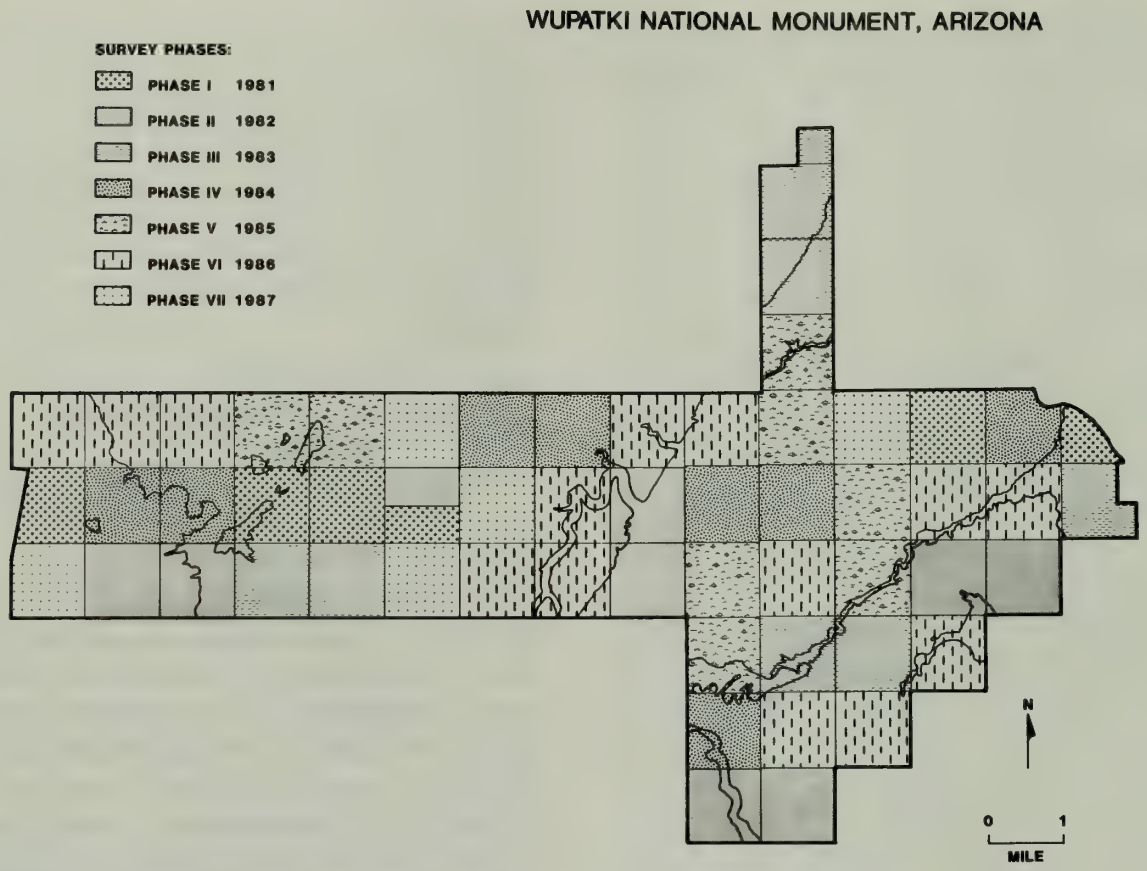


FIGURE 1.4. Survey Phases.

manuscript and helped to give direction to overall project goals.

In attempting to develop research questions for the project, prior to beginning the fieldwork, I relied heavily on previous archeological investigations of the area (see Table 1.3 for an overview of the archaeological history). I was interested especially in previous surveys done on Wupatki National Monument lands to better understand site densities and to view how sites were recorded. It was known that most of the prehistoric sites would show a mixing of cultural attributes--primarily Kayenta Anasazi, Sinagua, Little Colorado Anasazi, and Cohonina. Equally, the bulk of those sites should not exhibit features on the surface that would allow easy differentiation of cultural attributes. Finally, the ceramic assemblages would also be mixed and would require percentage breakdowns to determine major cultural affiliations. It was also known that it might be difficult to distinguish between Navajo and Hopi developments, early National Park Service activities, ranching, and mining activities, which could have similar historic cultural remains on the surface (Anderson 1981:10-11; Anderson 1982:3-4). In order to address the question of who lived in the area throughout time and how to date that occupation, several approaches were considered:

1.Architectural differences. These include room size variations, site layout, and cultural preferences for differing types of construction materials.

FIGURE 1.5. Stylized Drawing of Wukoki.

TABLE 1.3. Archeological History of Wupatki.

1853	A report is made by Lorenzo Sitgreaves during the 1851 military expedition down the Little Colorado River Valley.
1900	Archaeologist Jesse Walter Fewkes photographs and maps the larger ruins.
1924	Wupatki National Monument is established through the efforts of Harold S. Colton, Samuel A. Barrett, and others.
1931	The Heiser Spring pithouses are excavated by Lyndon L. Hargrave.
1933	The Museum of Northern Arizona (MNA) conducts excavations at Wupatki and Nalakihu pueblos. Charlie R. Steen of the National Park Service does a survey near Citadel Ruin.
1936	Erik K. Reed and James W. Brewer excavate Room 7 at Wupatki Pueblo for use as an interpretive display.
1948	Watson Smith of the Museum of Northern Arizona completes excavation of four sites and a survey of about 1,600 acres.
1953	Zorro A. Bradley excavates three fieldhouses.
1963	Michael B. Stanislawski writes his dissertation on architecture and material remains from Wupatki Pueblo.
1965	Alexander J. Lindsay, Jr., and George J. Gumerman conduct MNA excavations of the Wupatki ball court.
1968	The National Park Service excavates site NA 2077, and the work is reported by Albert E. Ward in 1976.
1977	Arthur H. Wolf and Dana Hartman of MNA write an archaeological assessment report on Wupatki National Monument.
1981-1987	Bruce A. Anderson directs an inventory survey of Wupatki National Monument by the National Park Service.

2. Ceramic differences. These can be established by developing sherd percentages for the sites recorded, petrographic analysis of specialized collections, and microseriation of some of the ceramics recovered.

3.Definition of intrusive, This can be established through additional research on trade routes, trade centers, and nonintrinsic cultural remains.

4.Dating. By necessity the pottery sherds and other surface artifacts must be utilized to provide chronological estimates.

Regarding the second question, that of settlement patterning, it is assumed that cultural affiliations can be established and that some patterns will be recognizable that exhibit change through time. Information about this question should be derived from:

1.The relationship of large and small sites and the relationship of sites to resource areas.

2.The distribution of sites in relation to vegetation and soil zones.

3.Site types: fieldhouses, habitation sites, and special activity sites.

4.Site densities, derived from survey maps and cluster analysis.

The third question, that of ashfall relationships, was approached from references discussing a major migration of people into the area following the eruption(s) of Sunset Crater to take advantage of increased arable land. A problem that exists for the area is that most pre-eruptive sites are now covered with cinders, and information about these sites is very limited. It would be useful, however, to (1) obtain a detailed geological map of the Wupatki area for comparison with site distributions; (2) compare habitation sites with agricultural use areas within the ashfall area; (3) closely examine exposed erosional areas within the ashfall area for possible pre-eruption sites; and (4) look for other geological and soil relationships to cultural resources.

Concerning the fourth question, agricultural usage, special emphasis was given to (1) detailed recording of all agricultural features; (2) investigation of all agricultural potential; (3) some limited analysis of carrying capacity and production estimates; and (4) attempting to describe variations in prehistoric farming practices.

Question five deals with how water was stored and manipulated prehistorically within an area that is generally considered to have been environmentally marginal for several hundred years. Water utilization and water resources were also recorded on the extended form for each site. Also, to deal with question five, the analysis of carrying capacity and production may offer some clues, as will some of the previous groundwater studies. This question and that of agricultural usage are closely interrelated but were kept separate to identify and discuss water sources and water usage without having to necessarily tie them agricultural development.

Question six considers what resources were available and how they were exploited. These resources could include almost anything that was utilized (i.e., specialized plants collected for nonfood purposes, stone for building and tool manufacture, wood for fires and construction, clay for mortar and potterymaking, minerals for dyes, and items traded or transported from elsewhere. All other resources and resource potential also became lumped under question six, and

several approaches will be utilized for this question:

1.Geological and vegetational maps will be carefully studied, including scope and aspect.

2.Field observation and recording of outcrops and quarry areas.

3.Comparisons of material cultural remains collected during the survey.

4.Review of the literature for source areas and types of resources being utilized should all provide positive information about this question.

Question seven deals with rock art and how it should be recorded. Wupatki National Monument contains extensive rock art areas. Some standards for the recording of petroglyphs and pictographs have been established (Swartz 1981:94-95). The National Park Service organized a task force to develop a rock art policy in 1982 (Berke 1981:5). Those two directives helped to guide the approach taken for rock art sites. It was necessary to draw and photograph all rock art elements so they could be compared and analyzed at the end of the survey project.

Question eight relates to historic use of the area (especially Navajo and Hopi involvement):

1.Architectural differences. The structural remains should provide information about varying cultural usages and preferences.

2.Historical documentation. Records checks and recent literature on the Navajo culture should provide information about how the Wupatki area was utilized.

3.Informant studies. People who have lived in the area for a long time could provide important information about site locations and uses.

Finally, the question of modern land usage was developed with thoughts about National Park Service developments, grazing rights, mining activities, trails and roads, shrines and markers, and all of those "sites" or areas where some human modification to the ground surface is present, but where specific or well-defined cultural relationships are not evident. Besides recording these features (both sites and possible non-sites), the approach would be much the same as it was for the historic sites:

1.Surface evidence should provide clues about actual usage.

2.Historic documentation should provide additional information.

3.Informant studies should also be useful.

Obviously, these questions are closely interrelated. My intent was to develop a few simple questions, which might at least be partially answerable from survey information alone. Equally, it was necessary to pursue those items that could provide valuable information for interpretative needs both for future research and present management of the National Monument. It was also requested to keep the questions simple and to the point so that they could be retained throughout all phases of the project. By retaining the same questions and refining the hypotheses on how to approach the survey becomes a very flexible research tool. Many researchers might argue that the above questions are too simple or vague to

address all of the research needs; but archeological information derived solely from surface evidence can be extended only so far.

Other Activities

Several additional aspects of the survey project relate directly to National Park Service concerns. These include:

1. Numerous archeological compliance activities for small developmental projects at Sunset Crater and Wupatki National Monuments (includes archaeological monitoring of the Loop Road Project in 1984).

2. Input on stabilization needs, with recommendations provided at the end of each project year (includes information providing for a park-wide stabilization assessment in 1987 and emergency stabilization work on Wukoki Ruin in 1981).

3.Input on interpretation needs, with the emphasis on planning for updating exhibit designs and cataloguing collections (includes periodic updating of survey information for the park interpreters about the project).

4.Input on protection needs, with follow-up on ARPA-related case incident reports and limited assistance with search and rescue situations (includes assisting park rangers in monitoring cultural resources and helping to curb visitors from surface collecting artifacts from archeological sites).

5.Providing seasonal training for park employees (includes encouraging the park staff to work with the survey crews in the field to observe and learn more about the park's cultural resources).

It is hoped that this initial discussion of the background, purpose, methodology, research, and other activities involving the Wupatki Archeological Inventory Survey Project will set the stage for the following chapters of this manuscript. It should be fairly obvious that with the extensive planning that went into the project, both before it began and throughout the seven years of fieldwork, a tremendous amount of data was generated and recovered. This information will be utilized in several different ways in the following chapters and should help clarify what we now think happened from prehistoric to modern times at Wupatki National Monument.

Chapter 2

Site Types and Cultural Perspectives

By Bruce A. Anderson

In order to discuss the variability of the numerous cultural sites and features found at Wupatki National Monument, this chapter is a beginning point. This section will discuss some of the previous work, the listing of sites, variations, and cultural manifestations, and will then attempt to formulate some conclusions. Chapter 5, which discusses site types and chronological placement of these types, will help supplement this chapter.

Previous Work

Dr. Harold S. Colton devoted much of his life to trying to understand the prehistory of the Flagstaff area, and with his work, his dedication to scientific inquiry, and his numerous publications on the area, the background for this section should begin. He was able to discern variability of archeological features, cultural features, ceramic differences, and regional differences at a time when many other researchers were not overly concerned with descriptions of or explanations for the variability. In 1918, he and his wife published a paper on small sites near Flagstaff (Colton and Colton 1918). Most archeologists at that time were only minimally concerned with small sites of any sort, and most research was concentrated on large, impressive sites, which would yield museum-quality specimens. This paper, actually written in 1916, began the numerous contributions Colton made toward a systematic archeological survey of the greater Flagstaff area from 1916 to 1928 on his own initiative, and from 1928 on with the Museum of Northern Arizona (Hargrave 1933:15). In 1932, Dr. Colton published an account of some of the ruins found at Wupatki and provided some site descriptions (Colton 1932b:30-41, to 61-65). This account gives the reader the first clue to the complexity and variability of sites within Wupatki National Monument, even if they have never visited the area. Samuel A. Barrett surveyed and made collections in

the Citadel area prior to the legislation for Wupatki National Monument (Barrett 1927; Hartman and Wolf 1977:7). In 1923, he was also the first individual to take note of the numerous petroglyphs in the Wupatki area (Barrett 1927:21, 27, 32, 57). See Chapter 9 in this volume for additional discussions of rock art. By 1933, the Museum of Northern Arizona had begun dendrochronological dating of Wupatki Ruin and started excavations there (Hartman and Wolf 1977:7). That same year, they also published work on Pueblo II sites in the area, in particular NA1754, the Heiser Spring pithouses (Colton and Hargrave 1933; Anderson 1980). At the end of 1933, excavations also began at Nalakihu, in the Citadel area (King 1949; Hartman and Wolf 1977:7). Along with the excavations at Nalakihu, an archeological survey of five surrounding sections of land was also conducted (Steen 1949). Finally, the bulk of the archeological research within the Flagstaff area was summarized by Dr. Colton (Colton 1946a; Downum 1988). This tremendous amount of background research laid the framework for later researchers to develop their thoughts on the archeology of Wupatki. It also provided a mechanism to describe and discuss site types and some of the variations that occur within those types.

After World War II, work began once again in the Wupatki area when the Museum of Northern Arizona conducted an archeological expedition in Big Hawk Valley (Smith 1952). Sites excavated in the National Monument included NA618 (WS-473), NA680 (WS-463), NA681 (WS-467), NA682 (WS-472), and NA537 (WS-831). Additionally, approximately three sections of land within Big Hawk Valley were surveyed for archeological sites prior to beginning the excavation process. This was done to assess the prehistoric occupation of the area and select sites for excavation that best addressed the many cultural mixing problems (Smith 1952:3-7). This excellent work provided a basis to better understand the archeological context of the western portion of Wupatki National Monument.

Additional background on small sites, and especially on fieldhouses, was provided in the following years (Bradley 1959; Pilles 1969, 1978); discussions of material culture and artifact types were expanded (Bartlett 1933, 1934; Stanislawski 1963); more archeological survey work was conducted south of the Monument (Parry 1981); and a synthesis of the importance of volcanic activity in the area was published (Pilles 1979). Finally, an archeological assessment of Wupatki National Monument pointed out the need for a comprehensive site survey (Hartman and Wolf 1977:31). With all of this bulk of previous archeological research and information on the context of archeological remains, I was provided with a mechanism for viewing the cultural remains during the survey process. This background was equally necessary to describe the types of sites and archeological features that were found.

Listing of Sites

Prior to beginning the archeological inventory survey in the summer of 1981, a scope-of-work and research design for the project was prepared (Anderson 1981). Throughout the course of the fieldwork, a preliminary report for the previous year and a revised research design for the following year were also published (Anderson 1982, 1983, 1984, 1986, 1987; Anderson and McKenna 1985). These reports listed all of the archeological sites recorded during the year. The list gives the field number of each site, the date it was recorded, its general location, a brief description of the type of site, a

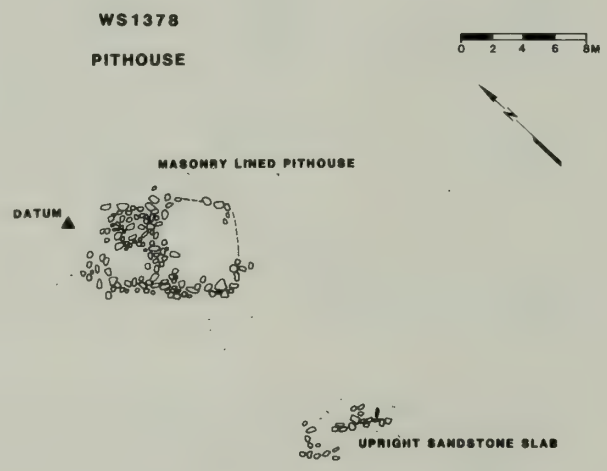
chronological time period for the site, recommendations for stabilization, and collection information. The complete list is included in the microfiche section at the back of this volume because it was too lengthy to include with the text of this chapter. This running inventory list for each phase of the survey work (Phases I through VII) also helped to formulate Table 2.1, which will follow at the end of this section. Additional site lists include: (1)a correlation between NA numbers (Museum of Northern Arizona site numbers) and WS numbers (Wupatki National Monument site survey numbers); (2) "ARSAP" files, a computerized list including locational information, site size, time period, and other archeological data; (3) a "Cultural Sites Inventory," which will be an expanded computer listing; and (4) a Northern Arizona University, Museum of Northern Arizona, and University of Arizona list to fulfill the State of Arizona cultural inventory requirements. In addition to and complementing these computer lists are the individual site forms, plan maps, aerial plot locations, artifact catalogue lists, and other data generated by the Wupatki Archeological Inventory Survey Project. With this information at hand, and utilizing all of the previous work already considered, site type information can be discussed. Table 2.1 lists these types, broken down for each phase and then totaled in the right-hand column. It also breaks down some of the "other" categories discussed in the research perspectives section of Chapter 1.

Site Types and Variations

From Table 2.1 it is obvious not only that the number of sites, site types, and site features is overwhelming, but also that there is also a great deal of cultural variation present. This section will discuss each of the types listed within Table 2.1 and describe some of the range of variables within the type.

Pithouse Villages

There is considerable distribution within this type, ranging from one or two structures (Fig. 2.1) to numerous depressions with artifact scatters around them. Surface indications for these structures are generally a very shallow depression or a series of depressions, which could be also be cists, kivas, quarrys, clay borrow pits, etc. At WS-623 (NA1754), there were two pithouses, a kiva, and a masonry room block present, and surface indications revealed only the three depressions (Anderson 1980:6). Only through excavations can the true extent and nature of these structures be revealed. Generally speaking, however,



FFIGURE 2.1. WS-1378, Pithouse.

TABLE 2.1. Site Types

	Phase I	Phase II	Phase III	Phase IV	Phase V	Phase VI	Phase VII	Total
Pithouse villages	3	7	2	5	4	4	3	28
Unit pueblos	16	26	22	41	39	24	4	172
Rock art	14	11	30	14	40	21	2	132
Hogans	2	9	12	12	32	21	1	89
Corrals	2	11	7	5	13	13	-	51
Sweathouses	1	3	2	2	4	3	1	16
Cists	18	36	19	28	23	12	5	141
Terraces	4	5	2	2	4	1	-	18
Ramadas	-	4	2	9	2	1	-	18
Hearths	-	-	3	8	1	3	1	16
Rock shelters/overhangs	1	25	25	23	26	77	-	177
Possible burials	37?	3	-	3	4	2	-	49?
Cairns	8	9	3	7	11	21	4	63
Dams and reservoirs	3	-	1	-	1	3	-	8
Fences	-	1	-	-	2	3	-	6
Walls	4	5	26	24	44	21	1	125
Fieldhouses	135	246	139	207	144	326	177	1,374
Depressions	21	28	14	31	17	11	17	139
Shrines	-	-	-	1	5	7	-	13
Isolated kivas	-	-	1	1	1	-	-	3
Catchments	3	-	3	2	6	3	2	19
Camps	6	6	2	2	3	5	-	24
Slab pens/small corrals	-	-	-	-	2	2	2	6
Trash dumps	2	3	2	4	17	13	3	44
Lithic scatters	-	2	-	1	4	3	-	10
Sherd scatters	6	2	1	4	8	9	3	33
Combination scatters	1	1	-	2	2	3	-	9
Borrow pits	2	-	1	-	2	2	-	7
Highway dumps	11	7	2	2	3	10	8	43
Windbreaks	4	5	4	5	10	13	37	78
Quarries	6	4	-	4	11	3	3	31
Enclosures	56	111	113	150	181	148	20	779
Check dams	1	5	8	7	16	17	1	55
Earth cracks	1	-	1	1	5	1	-	9
Field systems	46	30	26	38	71	52	15	278
Children's playhouses	-	2	1	1	-	1	1	6
Community rooms	-	-	-	1	1	-	-	2
Trading post	1	-	-	-	-	-	-	1
Squaw dance area	-	-	1	-	-	-	-	1
Springs	-	2	-	1	-	-	-	3
Other categories:								
Unknown	69	52	114	164	147	203	126	875
Historic sites	64	58	61	25	49	50	5	312
Agricultural usage	120	298	142	226	167	317	92	1,362
Water control	5	5	12	10	14	10	3	59
Resource exploitation	4	4	-	5	9	3	2	27
Park development	6	6	2	5	2	12	-	33
Stabilization recomm.	6	7	7	26	29	13	1	89[a]
Collection	82	59	55	60	63	125	45	489[b]
Testing recomm.	5	12	23	20	25	34	21	140[c]
Total of Sites	268	423	331	435	388	595	228	2,668

[a]Ca. 3% of total sites.
[b]Ca. 18% of total sites.
[c]Ca. 5% of total sites.

Some additional commentary on Table 2.1 may be required to understand the numbers being presented. Phase I through Phase VII represents the years of fieldwork (1981 through 1987). The "total" column shows the total numbers of site types or features located during the course of the survey. Under "other categories" the total represents the number of sites which were best represented under that category (totalling 2,668). The number of sites which were recommended for stabilization and testing stand on their own, as does the number of sites which had materials collected from them. Finally, the percentages are listed below for the total number of sites represented, to give an indication of what is being suggested to management for preservation needs.

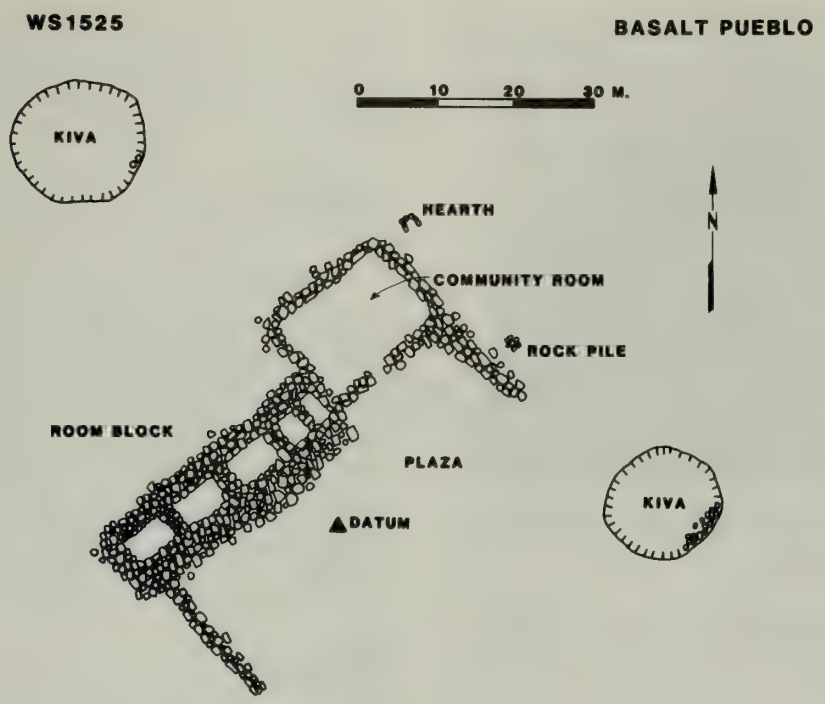


FIGURE 2.2. WS-1525, Basalt Pueblo.

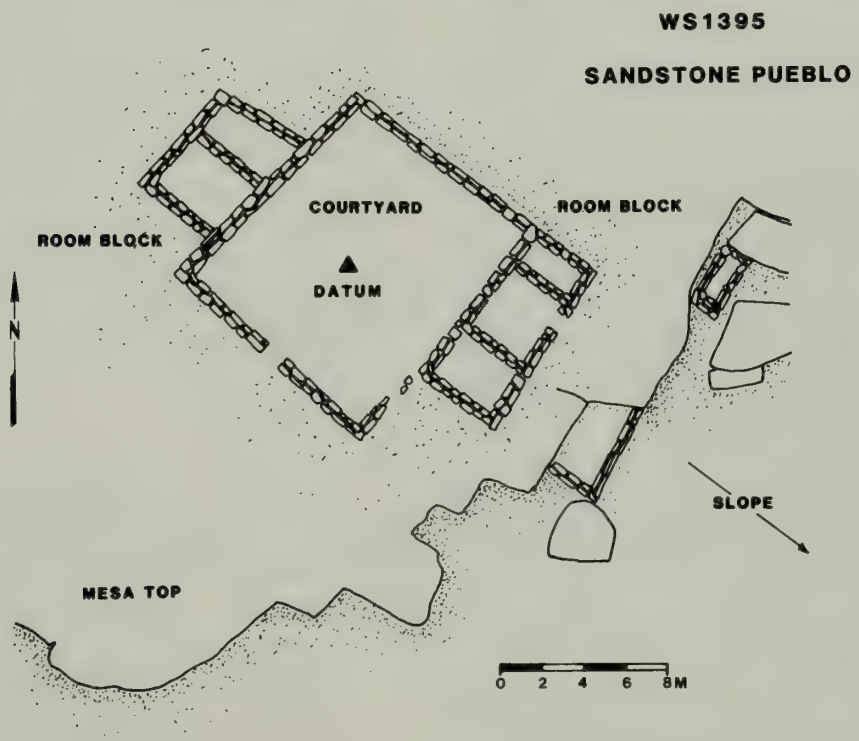


FIGURE 2.3. WS-1395, Sandstone Pueblo.

FIGURE 2.4. WS-249, Standing wall which was recommended for stabilization treatment.

they often have a fire hearth in the center, and they probably made excellent dwellings.

Unit Pueblos

Again, there is a wide range of variability to these structures. These dwellings ranges generally from two to five rooms and can extend up to the size of Wupatki Ruin (ca. 100 rooms, the largest site recorded at Wupatki National Monument). Some of the different plan layouts throughout the area are illustrated in a few of the reports mentioned above (Colton 1946a:52-63; King 1949; Steen 1949; Smith 1952). Stone types also vary: red sandstone, yellowish limestone, and black basalt are utilized. Often, combinations of these stone types appear in the construction of unit pueblos. Figures 2.2 and 2.3 illustrate different plan views where only one major type of stone was utilized. The name "unit pueblo" was coined by T. Mitchell Prudden (1918) who described this type. A unit pueblo is a square-cornered, flat-roofed, one-storied pueblo generally found within open-country situations (Prudden 1918:45). This pueblo layout is normally rectangular, with surface rooms, pit depressions in front, and a refuse area; with this orientation, there is always a front and back (Reed 1956:11).

Rock Art

Within the 132 rock art sites located at Wupatki, there were 455 different panels and 1,838 individual elements. Figure 2.5 illustrates one of the more complex sites. Additional discussion of rock art follows in Chapter 9. Many of the geometric forms represented in the Wupatki rock art suggest some association with either ceramic or textile designs (Schaafsma 1987:26).

Hogans

Figure 2.7 illustrates a hogan complex with a square hogan, a round hogan, and a corral in a small drainage. In many of these Navajo sites you might also find other features such as wood chopping areas, ash piles, trash dumps, and sweatlodges. See Chapter 6 for a discussion of Navajo usage at Wupatki. Many different types of hogans were located during the survey; included were dry-laid rock hogans (like those illustrated), forked-stick hogans, cribbed-log hogans, and many-legs hogans.

Corrals

There is a wide range of diversity to these structures. They can be constructed of dry-laid rock slabs, sheep-wire fences, cribbed logs, or juniper logs and brush, like the one illustrated in Figure 2.9. Frequently only a sheep manure deposit will be left where the remains of a corral existed because the corral wall materials were removed to be utilized elsewhere. Often, narrow arroyos and box canyons were util-

FIGURE 2.5. WS-1802, Rock Art Panel.

FIGURE 2.6. WS-1556, prehistoric petroglyphs pecked into a basalt outcrop.

FIGURE 2.8. WS-2303, a "many-legs" forked stick hogan.

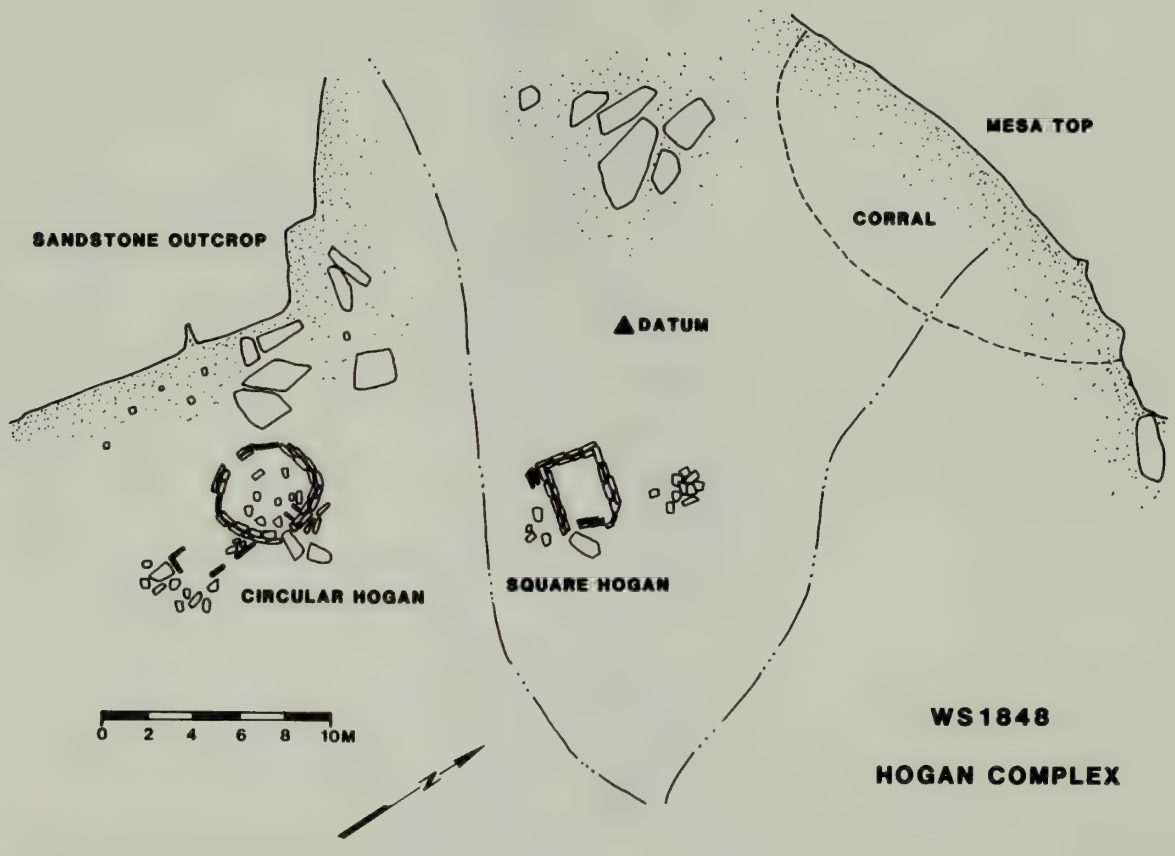


FIGURE 2.7. WS-1848, Hogan Complex.

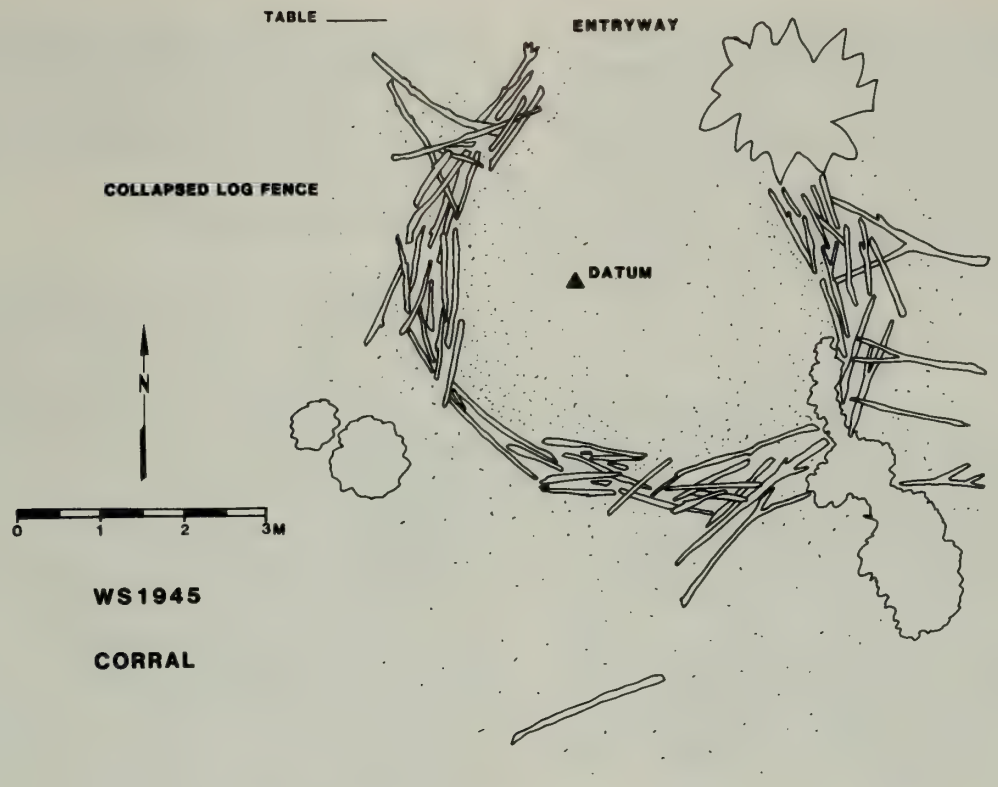


FIGURE 2.9. WS-1945, Corral.

ized for corrals, but occasionally they were also found in open flats.

Sweatlodges

Also called sweathouses, these structures were utilized for sweat baths by heating rocks inside them. Even if these structures were removed, the piles of burned rock revealed their usage. Figure 2.10 and 11 illustrates one of these features. Generally, sweatlodges are found away from the hogan site in an isolated situation.

Cists

Generally, these features are revealed on the surface as small slab-lined depressions. They are utilized as small storage units or granaries and as burial crypts. Usually they are not much larger than 1m in diameter, unless they are burial cists.

Terraces

These stepped gardens utilized the slope situation to control runoff and slope wash. Three large basalt walls (each ca. 1m high) below Citadel Ruin, form the "terrace garden." While these terraces, which are filled with trash midden deposits, strongly suggest they were used as garden plots, they still require archeological testing (Colton 1960:97).

Ramadas

WS-1429 was a temporary campsite which was utilized until the 1960's (see

Chapter 6), and had a ramada structure. Figure 2.12 illustrates this brush structure, and the additional trash scattered around the perimeter of the ramada. Most of the ramadas recorded on the survey were no longer standing, or only the only the main support posts were left in place.

Hearths

Only a few hearths or fire-pits were recorded during the survey process (a total of 16). Probably many more occur within the room-blocks of the larger sites, but only test excavations will reveal this. Because there was generally no artifacts around the hearths recorded, it was difficult to date most of these. Some of those recorded may contain enough burned wood that C14 dating would be possible if samples were collected.

Rockshelters/Overhangs

Within the deep narrow canyons of Antelope Wash, Deadman's Wash, and Kana'a Wash are numerous rockshelters and overhangs containing archeological remains. Figures 2.13 and 2.14 illustrate this type of site. WS-1953, located in Antelope Wash, contained a burial with a Tusayan Polychrome bowl on the surface associated with the individual interred in the shelter's fill (additional discussion of this ceramic vessel will follow in Chapter 7). WS-1914, located on the slope of Doney Mountain, contains rock walls within the shelter. Similar small, walled features occur in several of the 177 shelters located, especially to protect the opening of the shelter from the weather. Some of the sites in Antelope Canyon utilized grass rather than adobe for mortar between the courses of stone (Euler 1954:393-394). Rock art elements also appear in many of these sheltered situations.

Possible Burials

There were a total of 49 (?) burials located during the survey, most of them from WS-79, north of Citadel Ruin. This site revealed 37 slab-lined shallow depressions remaining on the surface of the excavated burial area (Barrett 1927:26, 27; Steen 1949:map). It was impossible to determine if all of the 37 depressions contained human remains (some were potted long before the site was ever recorded), and if some of the other surface features recorded were in fact graves. Not included within this count were the human remains excavated in Big Hawk Valley (Smith 1952), at Nalakihu (King 1949), and at Wupatki Pueblo (Stanislawski 1963:53-60), nor the single burial salvaged from near Citadel Ruin (Hartman 1973:1-7).

Cairns

Numerous piles of stacked rock located during the inventory survey process were defined as cairns. Both historic and prehistoric, they can be constructed for a variety of purposes. Often, when Navajo herders are out tending sheep, they stack small cairns and markers. Cairns can also serve as boundary markers for the clan or villages in the Hopi area (Scott 1977:12-14). They can also be utilized for agricultural field markers, and possibly as shrines. Generally, most of those located at Wupatki tended to be on high mesa tops or promontories with a long line of sight.

FIGURE 2.10. WS-1526, Sweat lodge

FIGURE 2.11. WS-1526, the same sweat lodge as illustrated in FIG. 2.10.

FIGURE 2.12. WS-1429, a Navajo ramada and camp.

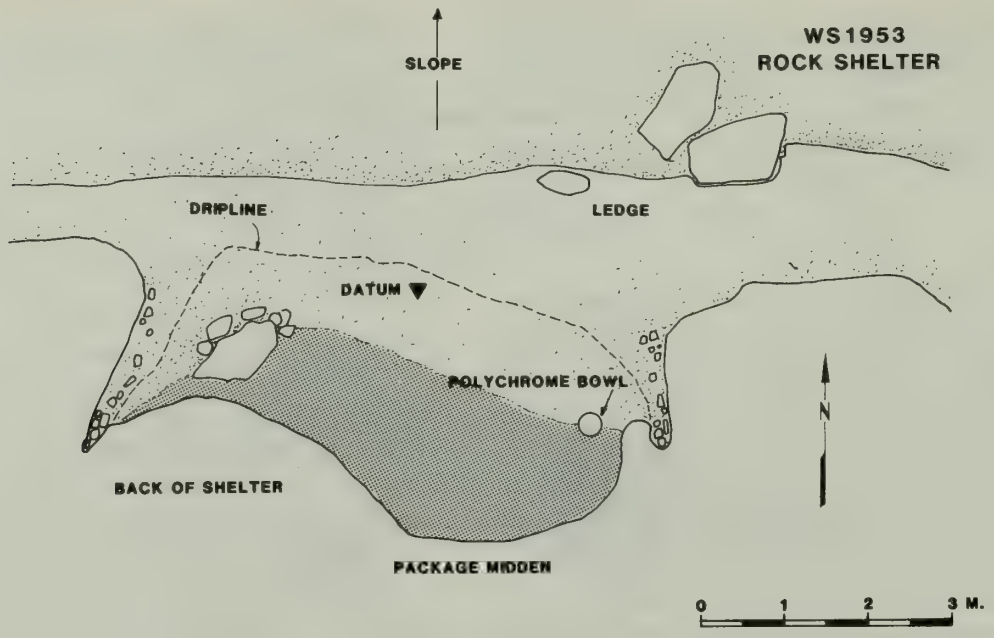


FIGURE 2.13. WS-1953, Rock Shelter.

Dams and Reservoirs

There are a few natural catchments or drainage situations where artificial prehistoric and historic dams have been constructed for the accumulation and holding of water. Two of these (WS-165 and WS-224) have been archeologically tested (Ritterbush 1984). These are somewhat larger and more complex than "check dams," which will be discussed later in this section. Most of these reservoirs still hold water during the rainy season and are watering areas for the wildlife living at Wupatki today. Figure 2.17 illustrates one such site and another element usually found with them-the sherd scatter. Most of the broken ceramics found with dams, are jar sherds (indicating probable breakage during the collection of water at the site). Prehistorically, periodic maintenance also would have been necessary for the removal of silt from these water collection areas (Turney 1985:45).

Fences

These refer solely to wire or milled-board historic fences. (Stacked-rock fences were called walls). Sheep wire, barbed wire, and milled lumber were used for these sheep enclosures and barriers.

Walls

In a few situations, isolated walls were found that did not appear to have been constructed for a logical purpose (generally, they were windbreaks, corrals, check dams, rooms, etc.). These features, also utilized historically and prehistorically, were constructed of dry-laid stone. There are numerous situations where this type of feature is found: as barriers around a mesa edge, enclosing plaza areas, along a trail edge, closing off an area to form a corral or room, to form windbreaks, to serve as benches, and to connect other features together as a unit. Walls are constructed of

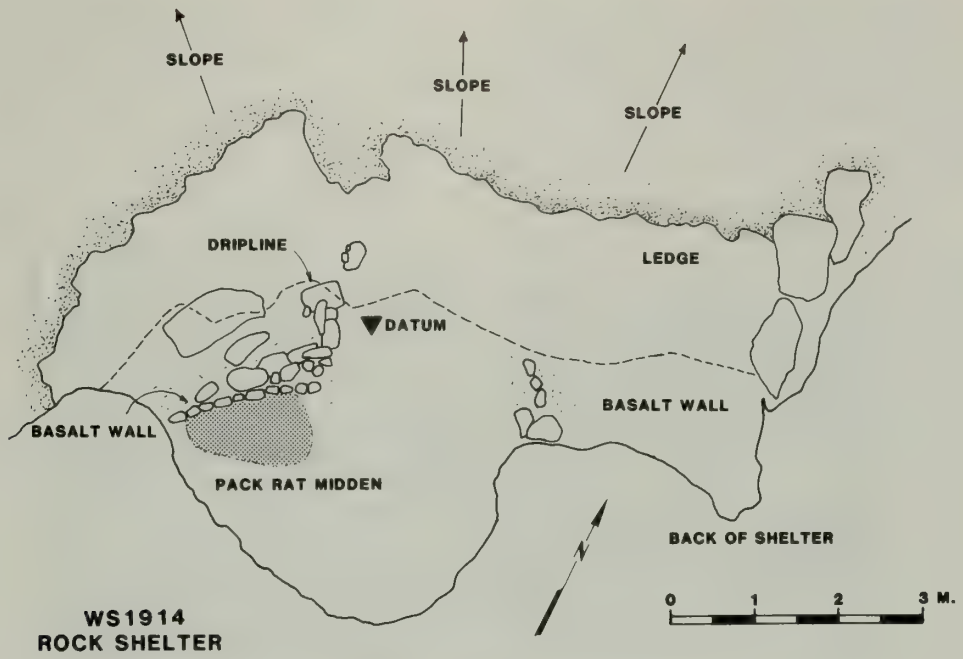


FIGURE 2.14. WS-1914, Rock Shelter.

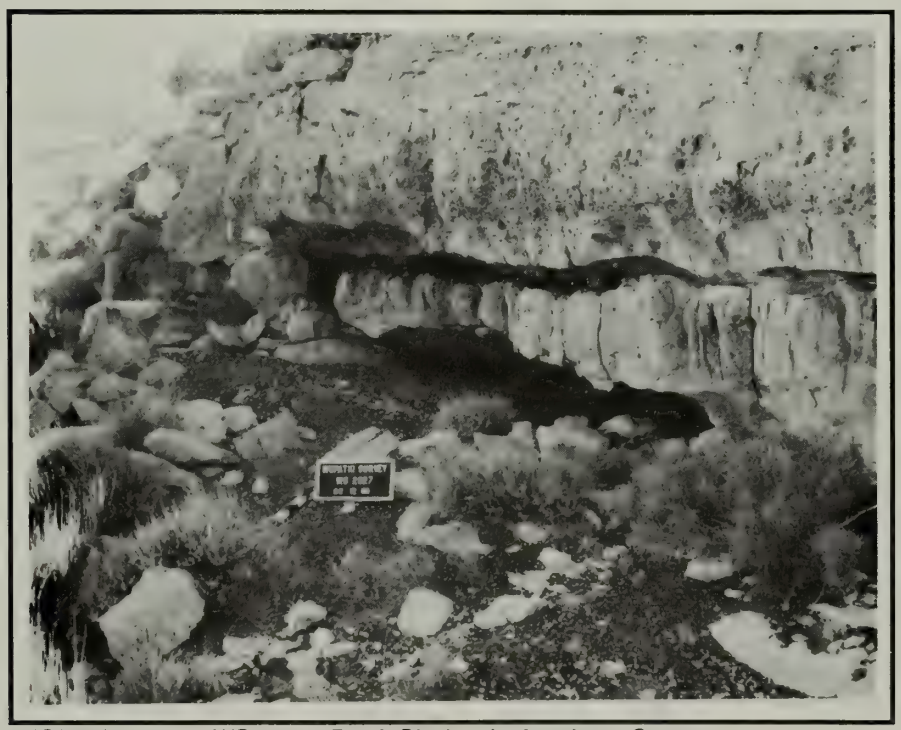


FIGURE 2.15. WS-2027, Rock Shelter in Antelope Canyon.

FIGURE 2.16. WS-1763, Stacked rock cairn.

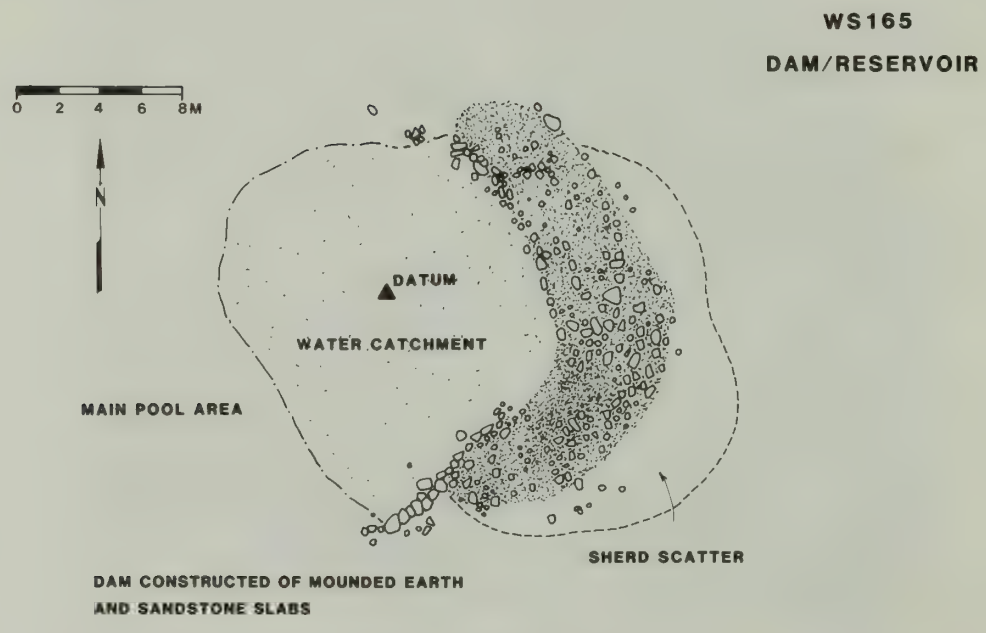


FIGURE 2.17. WS-165, Dam and Reservoir.

sandstone, limestone, basalt, or a combination of these types of rock.

Fieldhouses

This type is the largest category found at Wupatki National Monument (1,374 total). Because of the damaging effects that rodents would have had on crops, the high number of these structures may have been required for nearly constant supervision of the fields (see Chapters 3 & 4 for some discussion of garden hunting). These small sites are generally thought to be a function of seasonal agricultural activities (Colton and Colton 1918:124-125), and they have also been referred to as granaries (Colton 1946a:98). "Fieldhouses are characterized as small, one to four room masonary structures with walls one meter or less in height" (Pilles 1978:120). Similar structures are quite numerous in the Flagstaff area (Pilles 1969:101), and by employing farming strategies that utilized fieldhouses, the Sinagua were able to successfully develop their agricultural usage of the area (Pilles 1978:132). Other terms for this type of site include "earth lodges," "alcove houses," and "stone houses" (Steen 1949:158-160); "surface storage structure," "patio house," "rectangular and circular surface structures" (Parry 1981:29-32); and "farmsteads," a term we utilized for multiroomed field structures (see Chapter 4 for more discussion of field structures and farmsteads). What Mark Sutton (1977:51-54) defined as a "farmhouse" probably best illustrates what we called "farmsteads." He felt that there was a full range of domestic activities represented, generally two or three rooms in the structure, and very limited ceremonial artifacts found within the site. These larger units are differentiated from more temporary structures of only one room (what would best be called a "fieldhouse"), where there are no domestic attributes noted, but which are located in field areas (Sutton 1977:58-60). A lack of fire hearths and limited trash is generally noted for what are considered temporary structures. As Figure

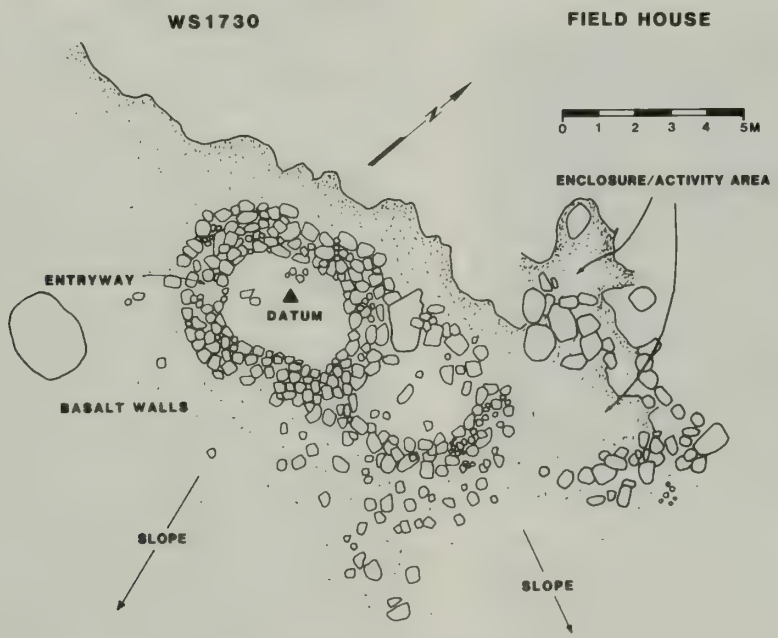


FIGURE 2.18. WS-1730, Fieldhouse.

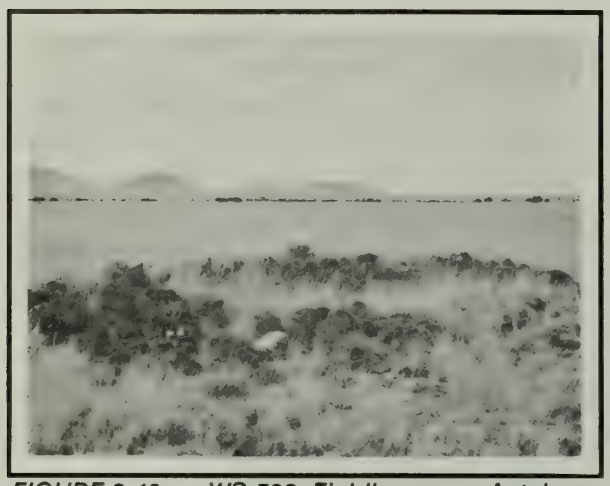


FIGURE 2.19. WS-522, Fieldhouse on Antelope Prairie.

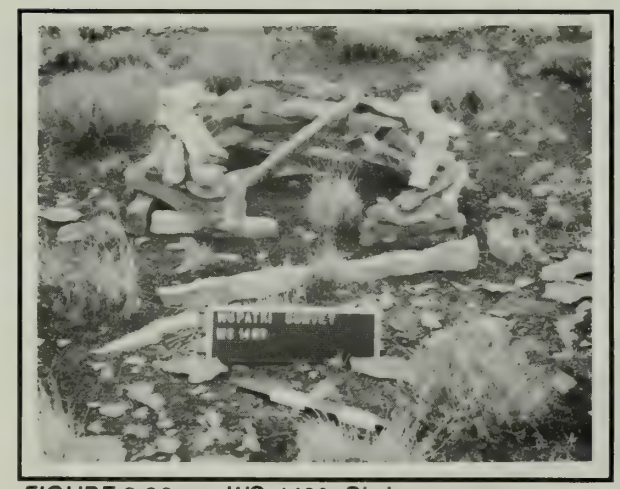


FIGURE 2.20. WS-1489, Shrine.

2.18 indicates, there can often be other features within the generalized fieldhouse area, such as enclosures (generally abutted against a rock face) and other activity areas. Enclosures will be discussed later in this section. Further excavation of more of these small sites or structures is required to better determine their usage (Bradley 1959:22).

Depressions

This is a catch-all term for any subterranean feature. They could be pithouses, kivas, cists, quarries, or burials, and excavation would be required to determine what the structure really was. Some associations can sometimes be suggested, however, if other above-ground features, are present at the site. Also, with the deep cinder deposition at many of these sites, some of these shallow depressions may be totally filled and not visible on the surface. Testing was recommended for many of these unknown features which are discussed in the conclusion of this chapter.

Shrines

Shrines for hunting often are utilized by the Hopi (Beaglehole 1936:8, 11, 22). There are also shrines for villages, clans, and specific deities in agricultural plots and eagle collecting areas (Scott 1977:5-11). These features are generally constructed of upright sandstone slabs and usually have pahos or rock art associated with them. The only active shrine known within Wupatki National Monument is near a blowhole in the western part of the Monument. It has been suggested that there should be some eagle shrines on top of Doney Mountain, but positive identification could not be made for the features located there.

Isolated Kivas

Circular subterranean kivas in front of the pueblo and square or rectangular kivas within the room blocks have been described at Wupatki (Smith 1952:154-165). Three isolated, square, above-ground structures were also located during the survey process. Figure 2.21 illustrates one of these isolated kivas. This term is utilized to show that these features were not in direct association with the unit pueblos.

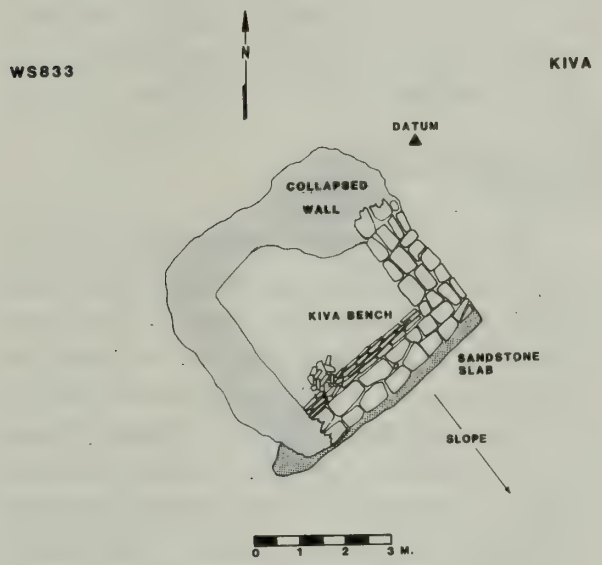


FIGURE 2.21. WS-833, Kiva.

Catchments

These are natural basins which hold water (readily observable during the rainy season of July and August). They provide the only source of water in the western portion of the Monument and were probably utilized prehistorically. Often, unit pueblos are located near or in the general vicinity of these natural features, which may have served as natural reservoirs. Like constructed reservoirs, they may have required periodic cleaning.

FIGURE 2.22. WS-1434, Excavated Kiva.

Camps

Both prehistoric and historic camp sites were found at Wupatki. The term generally refers to very short-term usage of the site perhaps only overnight. Generally, only minimal trash is found in association with camps. These sites were probably utilized for pinon gathering, lithic collecting, or sheepherding.

Slab Pens/Small Corrals

This site type is different from the larger corrals discussed above in that they are only large enough for one to four sheep. These features were probably utilized as lambing pens or to tend sick sheep, which were to be kept away from the main flock. Generally, these small pens were located close to a hogan, which would suggest this type of

usage. One of these sites had numerous canned milk cans just outside of the pen, which suggests that lambs were being bottle-fed at this location.

Lithic Scatters

Fragments of chipped and broken stone are found in these areas. Occasionally, hammerstones, utilized to break the rock, are also present. These sites can range in size from a small chipping station to a large lithic procurement area (generally within exposed gravels on the surface). See Chapter 3 for further discussion of these source areas.

Sherd Scatters

In these areas, ceramic sherds occur on the surface, where there does not appear to be any associated architecture. These areas may indicate buried features that could not be observed, family or clan areas or fields, pot drops, or prehistoric trash dumps.

Combination Scatters

Areas where both lithic and ceramic scatters occur without architectural features are called combination scatters. Most of the explanations given for sherd scatters also apply here.

Borrow Pits

In these areas, cinders, clay, sand, and gravel have been mined for modern park needs (for example, construction, road maintenance, and stabilization). There may have been smaller clay borrow areas utilized prehistorically, but this could not be determined during the survey process.

Highway Dumps

Along the Monument highway and Highway 89, there are numerous piles of rocks which were dumped near the edge of the road. This rock was evidently removed during the road construction activity and left at the edge of the right-of-way.

Windbreaks

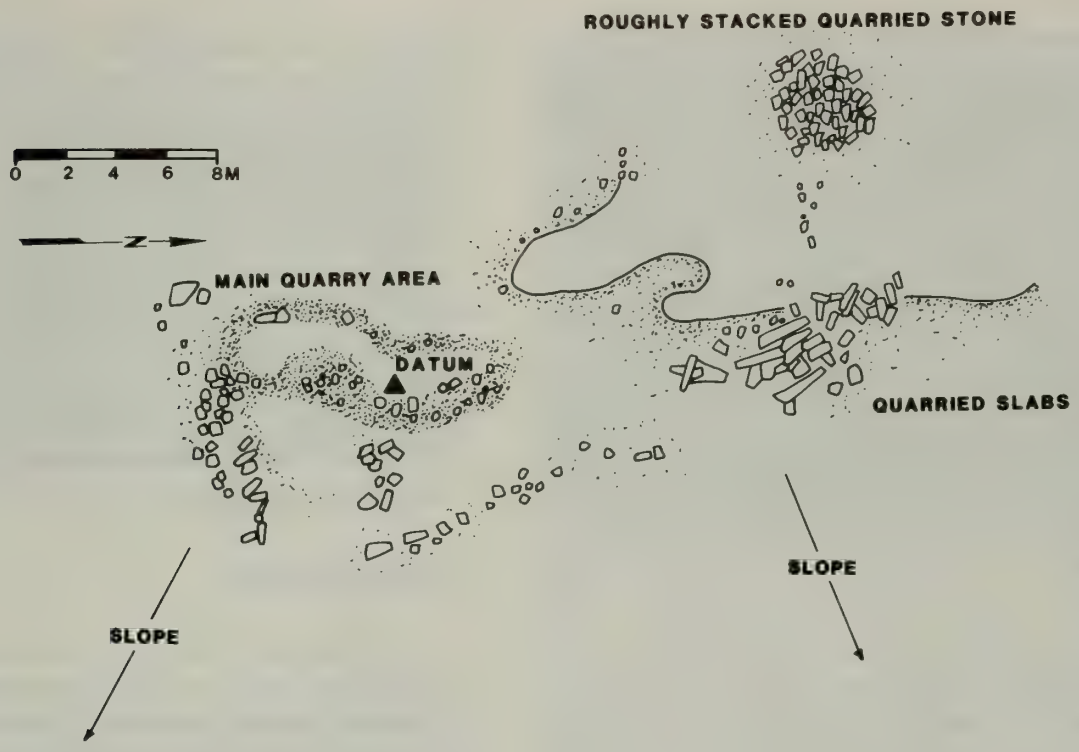
These low rock alignments, linear and sometimes elliptical, are generally perpendicular to the prevailing winds. They may have served as a foundation for brush to screen the wind, temporary shelters utilized while working the agricultural fields, blinds or shelters for hunting parties, or temporary camps. Generally, very limited cultural materials were located near these structures, often only one or two sherds, suggesting short-term usage.

Quarries

Areas where building stone was obtained and stockpiled were called quarries. Generally, these were areas where sandstone slabs were obtained from the Moenkopi outcrops, which occur throughout the Monument. This is not to say that basalt boulders and limestone blocks could not have been quarried also, but evidence for this was not as obvious as it was in the sandstone areas. Figure 2.23 illustrates one of these sandstone quarries. Due to the lack of any artifacts at this site, it was impossible to determine if it is prehistoric or Navajo.

Enclosures

This morphological unit refers to features that utilize a natural outcrop or over-



hang as part of the overall structure. Generally, they tend to be small units of stacked rock forming a semicircle against a sheer rock face. Usually there is also a lack of surface artifacts with these features, which makes it difficult to determine how the structures were actually utilized. Only one of these features has been excavated, and it was speculated that it was a granary (Steen 1949:159). As these features are often found near field areas and fieldhouses (as Fig. 2.14 indicates), there is a suggested agricultural association. (See Chapter 4 for additional discussion of agricultural systems). This type of structure constitutes the second most numerous morphological type (fieldhouses being the largest); 779 were recorded at Wupatki National Monument. Additional study and excavation should be conducted on these small features to better determine their function.

Checkdams

Within many of the smaller drainages, arroyos, and erosional slopes of the Monument, small rock alignments served to buffer the flow of runoff. These features are generally utilized to curb erosion within the fields at the Hopi Mesas (Birkedal et. al 1982:23). It has been suggested that the areas behind these small features may also have been utilized as planting surfaces, but this does not appear to be their major function (Doolittle 1985:287-289). The rate of erosion could be decreased by reducing the runoff velocity through this mechanism, and gullying would not occur (Doolittle 1985:298). These small erosion-control devices are almost impossible to date, as no artifactual materials are generally found in association with them. They have also been utilized by the Navajo and park staff for the same purposes that the prehistoric occupants built them for.

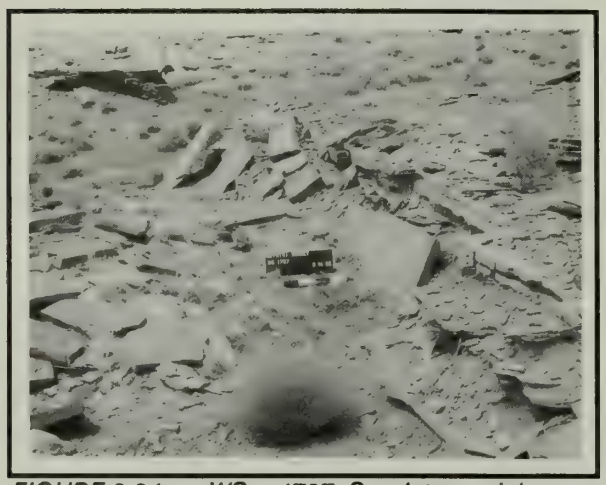


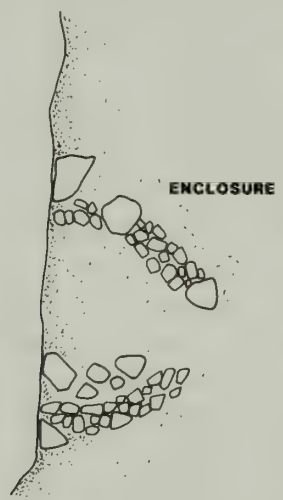
FIGURE 2.24. WS - 1787, Sandstone slab quarry.

Earth Cracks

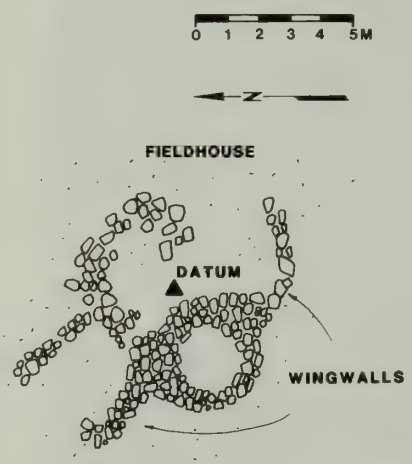
Faults paralleling grabens in the Kaibab Limestone are often open and appear as deep, narrow fissures known locally as "earth cracks" (Cave Research Foundation 1976:3). Additional discussion of these features will be presented in the geology section of Chapter 3. These natural features are included in this section on archeological site types because cultural features are often found in association with them (rock art, shrines, artifactual materials, and other forms of architectual modifications). Often they will contain materials that have fallen inside such as corn cobs, sherds, and faunal materials. In other situations, they may have been utilized for storage (see Chapter 7 for a discussion of a basket recovered from one of these geologic features).

Field Systems

Throughout Wupatki National Monument there are over 12,000 numerous field elements forming an amazing concentration of roughly 278 field systems. This intensive prehistoric agricultural development has been broken down into the following field types to better describe some of the many variations present: rock pile fields, simple fields, bordered fields, bordered gardens,



WS886



ENCLOSURE/FIELDHOUSE

FIGURE 2.25. WS-886, Enclosure and Fieldhouse.

FIGURE 2.26. WS-1177, Enclosure which is built into a basalt outcrop.

terrace fields, terrace gardens, composite fields, and cinder berm fields. Chapter 4 discusses all of these types at length. The highest concentration of these fields occurs within fairly shallow loam soils and where rainfall today appears the heaviest (Chapter 3 discusses these factors further). Corn agriculture requires a growing season of between 115 to 130 days, with sufficient rainfall for the plants to mature (Bradfield 1971:6-7). Within the Hopi area numerous lines of stones in sand dune field areas are utilized as wind breaks (Hack 1942:70-71). It is assumed that the many stone alignments found at Wupatki were used for the same purpose prehistorically. Additionally, Hopi farmers will sometimes divide their fields to systemize planting and to allocate portions of the fields to certain family members (Birkedal 1983:6). These gridded features could also help to explain the numerous alignments noted at Wupatki. Hopi and Zuni have both utilized boundary markers and field markers, and they are very land conscious (Ellis 1966:104). Some of the rock piles within the field areas may be prehistoric examples of similar markers, and others may only be evidence left from clearing the field area. Figure 2.27 illustrates a field system along the edge of Middle Mesa in the northwestern portion of the Monument, with rock alignments for diverting the runoff from the mesa top.

Children's Playhouses

These unusual features which all have a similar appearance, were certainly constructed by Navajo children living at Wupatki. One of the Navajo informants said that she and her siblings had constructed one of these sites when she was a small girl. These sites, which look like miniature room outlines are rectangular and look like minipueblos. One of these playhouses was built on top of a prehistoric ruin near the base of the Doney Cliffs (WS-2377).

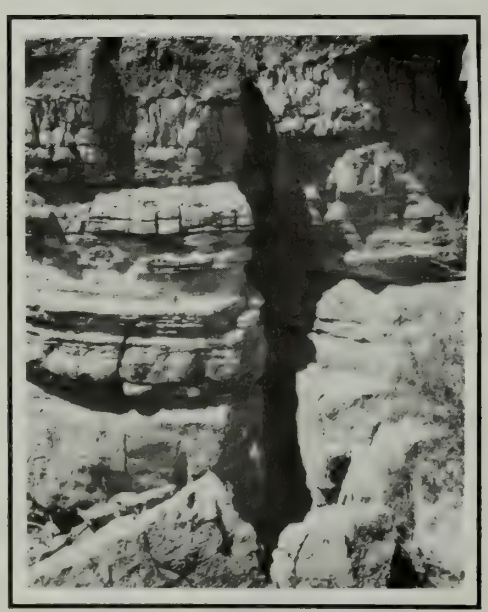


FIGURE 2.27. WS-1603, Entrance to Earth Crack.

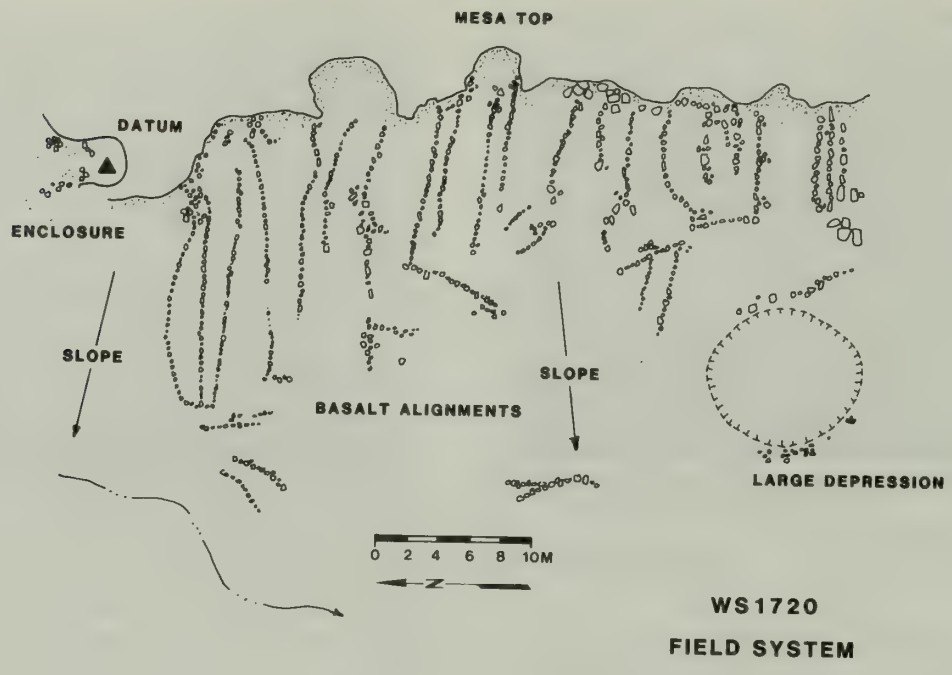


FIGURE 2.28. WS-1720, Field System.

Community Rooms

These large rooms generally occur with other, smaller rooms and are generally located on one corner of the room block. Only two of these structures were located at Wupatki. These large community rooms may have been used for ceremonial and social organization purposes (Pilles 1981:13). They are similar to ceremonial structures found in the Mogollon area (Pilles 1979:475). Figure 2.28 illustrates a community room.

Trading Post

One trading post was recorded within Wupatki National Monument boundaries, the Black Falls Trading Post (WS-7, NA14, NA583). Emmet Kellam opened this store on the west side of the Little Colorado River and operated it until it was sold in 1952 (Babbitt 1986:7). The Kellams spoke fluent Navajo and were good and fair traders to the local Navajo residents. From 1952 to 1963, five other traders operated the Black Falls Trading Post (Hartman and Wolf 1977:25). All of the buildings were completely torn down in 1964, and today only some foundation remnants remain (Hartman and Wolf 1977:29).

Squaw Dance Area

Several "Squaw Dances" (Enemy Way ceremonies) were reportedly held in the Monument during World War II. Only one recorded site may have served this function (WS-703). Others may have been obliterated to the point that they could not be recognized on the surface today.

Springs

Only three springs are known in Wupatki National Monument, and today only two

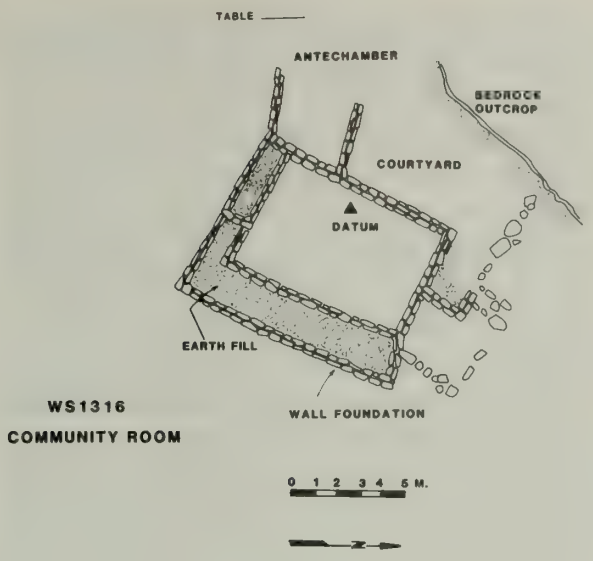


FIGURE 2.29. WS-1316, Community Room.

provide a source of water. In 1984, the park resource management specialist looked over several potential water sources to determine if supplemental water sources were obtainable (Cinnamon 1984:10). In 1935, Heiser Spring was measured as producing 1,005 gallons per day, and Wupatki Spring at 514 gallons per day. No measurement was given for the third, Cottonwood Spring (Brewer 1935a:106). As of 1984, only Heiser and Cottonwood Springs were still active. The latter flowing slightly, had become a major source of water for wildlife in the area. Heiser was utilized as a water source for human consumption (Cinnamon 1984:2). During prehistoric occupation of the area, there may have been many more water sources available, but these no longer exist today. More discussion on hydrology will follow in Chapter 3, showing how crucial water is for survival at Wupatki.

Discussion

This listing of site types was introduced to briefly present some of the many variations present within the cultural resources found at Wupatki National Monument. Many of the sites recorded included combinations of features and site types, and combinations of cultural attributes within the site area. Many also exhibited vague relationships to other sites in the vicinity. This is not to say that all sites were the same. Each one was different and stood on its own merit. Equally, this is not to say that the archeological sites located were always predictable; invariably, there were nonconformities in the system. Human adaptions to a particular location, drainage, soil type, outcrop, environmental setting, terrain, or some other logistical factor were not always expressed in the same way. Availability of resources (primarily building stone, wood for construction and fuel, and water) could enhance or limit an area for occupation. Many of the sites suggested a short timeframe for occupation, while others reflected long-term use, some with mixed prehistoric and historic cultural components, and some with a mixing of artifactual materials.

Thus, the variability and complexity of the cultural resources observed during the seven-year inventory survey process at Wupatki National Monument never ceased to amaze and confuse the crew members working on the project. Some of the sites had virtually no artifacts in association with the architectural features, and it was impossible to place the site in any chronological or a cultural context. Others had such a wealth of materials, covering several broad time periods and containing numerous ceramic types and other artifacts, that definitive interpretations became difficult during the recording process. Site size tended to be

variable also, ranging from one small, well-defined feature to numerous complex and varied features expanding over a large area, but still part of the same site. There were many frustrations involved with trying to record extensive field systems with numerous rock piles and alignments, and then trying to tie those into a fieldhouse or some other field structure within a reasonable distance from the field complex. Other times, the density of features was so great that it was difficult to determine which features went with each site. Section 6, T 25N, R 9E had 128 sites (the greatest number of sites in any square-mile unit surveyed).

As mentioned in Chapter 1, it was often difficult to assign a cultural affinity to many of the sites due to cultural mixing and the lack of artifactual materials found on the surface. Ceramics relating to the Sinagua, Cohonina, Winslow Anasazi, Kayenta Anasazi, Prescott, Hopi, and Navajo were observed. Historic glass, cans and other metal objects, lumber, wire, and other trash occurred on many of the late sites some of which could not be attributed to a particular cultural group. Only 10 sites of the 2,668 were thought to have preceded the eruption of Sunset Crater: WS-381, WS-598, WS-1033, WS-1048, WS-1475, WS-1586, WS-1589, WS-2237, WS-2266, and WS-2306. This would suggest that other sites may be buried under the cinders that were not observed during the inventory survey. Several early sites have been recorded outside of the ashfall area (east of the Little Colorado River). Thus, it should be obvious that absolute and finite interpretations are impossible for many of the sites at Wupatki National Monument. Several had to be labeled "unknown" because of excessive mixing or a lack of available cultural material.

Having discussed these limitating factors, I can now discuss the next portion of Table 2.1, "Other Categories," which deals mainly with various "functional" uses of the sites recorded during the inventory survey. They are broken down into "unknown" (sites or features where certain functions could not be assigned); "historic sites" (utilized by Navajo people living in the area or related to ranching, limited mining, or trading, by early Anglo settlers in northern Arizona); "agricultural usage" (field systems, terraces, fieldhouses, etc.); "water control" (springs, dams, reservoirs, catchments, check dams, etc.); "resource exploitation" (stone quarries, clay source areas, and sources for lithic procurement); and sites that could be attributed to some form of "park development" (stabilization and highway rock dumps, roads, parking areas, trails, borrow pits, housing areas, water lines, etc.).

Over one half of all the sites recorded (1,362) were related to some form of agricultural usage or activities, which confirms the emphasis that prehistoric people must have placed on crop production for survival. Certainly, many of the "unknown" sites were utilized for habitation purposes, but at the same time they may also have been used for craft manufacturing; food processing; storage of tools, supplies, and materials; ceremonial activities; social activities; and other daily life activities. More archeological excavations are required for better interpretation of many of these functional attributes and site utilization factors. Surface indications for many of these sites could only provide limited suggestions of site functions, especially if the surface materials were skewed or disturbed by unauthorized collection activities before the site was recorded; erosional factors that buried or removed a portion of the site; rodent activities that disturbed the fill within some of the features of some sites and buried others; and cattle

grazing which may have trampled surface materials into the ground and knocked down some standing architectural features. Equally, suggested site functions may not reflect the actual utilization of the surface features. Rooms may have been abandoned, and others may have filled with trash or been utilized for graves.

To address some of the problems involving cultural resource management at Wupatki National Monument, the final section of Table 2.1 illustrates some approaches taken. Stabilization recommendations made during the site inventory process, were followed by a comprehensive assessment of needs for stabilization treatments. The listing of classified structures (for those sites which had revealed above-ground architectural features) in Wupatki National Monument was revised to include all of the known sites recorded during the survey. With this available data at hand, a programmatic approach can now be taken to new stabilization needs, cyclic maintenance for sites that have had received stabilization treatment in the past, and the best ways to approach architectual features that will be exposed in the future or are exposed now. Only recently, the backfilling of exposed sites with recurring stabilization problems has been considered as a logical stabilization treatment. Many sites have been exposed for interpretive purposes without sufficient allowance for the added cost or other preservation problems associated with those actions (Metzger 1989:9). In some situations, the sites are self-stabilized and exist as a rubble mound exhibiting no need for additional work. In other situations, there may be a need for archeological testing of a particular feature

FIGURE 2.30. WS-249, Standing wall which was recommended for stabilization treatment.

or site excavation, with backfilling of the exposed features. With some sites, the information collected during the survey process and the artifacts collected at that time fully documents that site; with others, additional research is required for understanding the archeological context. A long-term research agreement has been developed between Northern Arizona University and the National Park Service to better address some of these needs. Finally, with the accessioning, cataloging, and recording of artifacts collected by the survey project, there was a recognized emphasis and requirement to provide a better accountability for all the materials that had ever been collected from Wupatki National Monument. This will allow for better inventorying procedures, better collection policies, a mechanism for selection of materials for new exhibit designs, and a overall collections management and protection statement, no matter where the artifacts are stored. Chapters 7 and 8 will discuss the material items collected by the survey archeologists between 1981 and 1987.

In conclusion, this chapter has tried to briefly describe some of the archeological variability, cultural manifestations, problems inherent within survey information, and ways in which the National Park Service can best utilize the data obtained from the inventory process. Without this baseline information, no conclusive statements on the cultural resources could have been made. There was no way to know what was needed without knowing what existed. Before the survey, limited interpretation of the park's resources invited groundless speculation. For example, it was estimated that there were "800 sites within the monument boundaries". Resources protection became almost totally limited to the larger known sites, with only limited concern given to backcountry use areas. It is now possible to monitor all of the sites for vandalism, erosion, site disturbance, and other factors of importance with routine patrols throughout the Monument. Additional recommendations can also now be made for other mechanisms to better protect these fragile resources. Any additional developments or ground-disturbing activities (road realignment, new building sites, parking areas, trails, or interpretive signs) planned for the future can avoid known concentrations of cultural resources and better preserve those sites for posterity. With the bulk of information generated by the archeological inventory survey process, other issues such as environmental and ethnoarcheological factors can also be addressed. It is strongly felt that this project should set the stage for all future thinking about cultural resources at Wupatki National Monument.

Chapter 3

ENVIRONMENT

By Bruce A. Anderson

Overview

Numerous studies have been conducted through the years which pertain to the overall environmental picture of Wupatki National Monument. Many of these studies were done in conjunction with archeological research or address the prehistory of northeastern Arizona. In this chapter I would like to discuss some of these previous studies, which pertain to six main subgroups: geology, soils, climate, hydrology, flora, and fauna. Some are more pertinent to the archeology than others, some are more important to the particular scientific discipline that is being described, and some are useful for overall interpretation for the National Monument. Without the background of these environmental aspects, the archeology and the prehistoric activities that took place would hold little significance. Equally, many of these studies cannot fully provide the answers necessary to totally interpret the cultural resources, but only provide clues about what occurred in the past. Some recent studies have attempted to fill in some of these gaps and are adding significant information to the data base. To provide some interpretation on how prehistoric populations were able to articulate within their environment and survive, utilizing what we might consider today as less than marginal resources, this section is necessary to clarify some of our thinking and perspectives.

Geology

The oldest visual formation exhibited at Wupatki National Monument is the Kaibab Limestone Formation. This formation is Permian in age (Nations and Stump 1981:120-124) and is found primarily within the East Kaibab Monocline (Babenroth and Strahler 1945:107-150). This fold is downthrown on the east side, which causes the strata to step down from higher elevations on the west toward the Little Colorado

River Valley. Many small grabens and minor single faults are also present. "Adjacent to these grabens are high angle, reverse faults that occur singly or in closely spaced sets. The faults parallel the grabens and are often open in the form of deep narrow fissures known locally as earth cracks. Where displacement is small the cracks have remained open; but where the displacement has been great, subsequent collapse of large blocks along joint planes in the Kaibab limestone have widened the cracks until they resemble Karst sinkholes" (Cave Research Foundation 1976:3). Also associated with these fissures or "earth cracks" are numerous "blowholes," which will be discussed below. Exploration of the Sipapu earth crack, near Lomaki Ruin, revealed that the Kaibab Limestone Formation is directly above the Coconino Sandstone Formation (Colton 1938:31; Cave Research Foundation 1976:9-12). The Coconino Sandstone is also Permian in age, approximately 280-240 million years old (Nations and Stump 1981:120-124), but it is not visible on the surface at Wupatki except in the bottom of Antelope Canyon (Breed 1976:8). There are numerous invertebrate tracks found in the Coconino Sandstone, but few fossil remains have been found (Brady 1939:32-34). Also, some trilobites have been recovered from the Kaibab Formation (Snow 1945:17-24). These are some of the last survivors of this once abundant class of animals. See Figure 3.1 for a generalized geologic map of the Wupatki area and Figure 3.2 for a geologic column cross section.

Exploration and survey of the fissures and "sinks" have helped to enhance the interpretation of these unusual geologic features. Doney Fissure is named after Ben Doney, who established a mining claim for it (calling it "Skeleton Mine") and built a series of ladders inside the fissure (Colton 1938:30). The Museum of Northern Arizona's investigation of this earth crack located a camel metapodial bone, some human bones, desiccated rabbits, pack rats, and a dog, as well as a few pottery sherds Colton 1938:30-31). The camel bone from this earth crack indicates that it has been open for at least 20,000 years (Cave Research Foundation 1976:3). In 1975-1976, the Cave Research Foundation surveyed in detail six earth cracks and three sink-like features, and tied together tectonic features associated with grabens (Cave Research Foundation 1976:1-59). The Sipapu fault, the deepest earth crack investigated, is about 500 feet deep and extends 265 feet into the Coconino Sandstone. The three sink-like features include Wupatki Sink, 130 feet deep; Arrowhead Sink, 140 feet deep, and the only one within the Monument's boundary; and Citadel Sink, 173 feet deep (Schley 1964:11-14). Arrowhead Sink (and probably the other two sinks) appears to have been formed from carination of subterranean sandstone along a vertical fault, with no evidence of solution playing any part in the formation process. "The only evidence of solution in the Kaibab is on the surface, where features may have been formed in part by solution action (Colton 1938:29; Lamar 1964:40), but this does not seem to be the case, as these features appear to be tectonic in origin,with no solutional passages encountered (Cave Research Foundation 1976:4). These fracture sets of the Wupatki Bench strike generally in northwesterly and northeasterly directions, roughly parallel to the localized faults (Kelly and Clinton 1960:75). A small earth crack in Cedar Canyon was surveyed by the Wupatki Archeological Inventory Survey crew in 1985, and a prehistoric basket was recovered from a ledge within this small fissure. This geological feature was given a

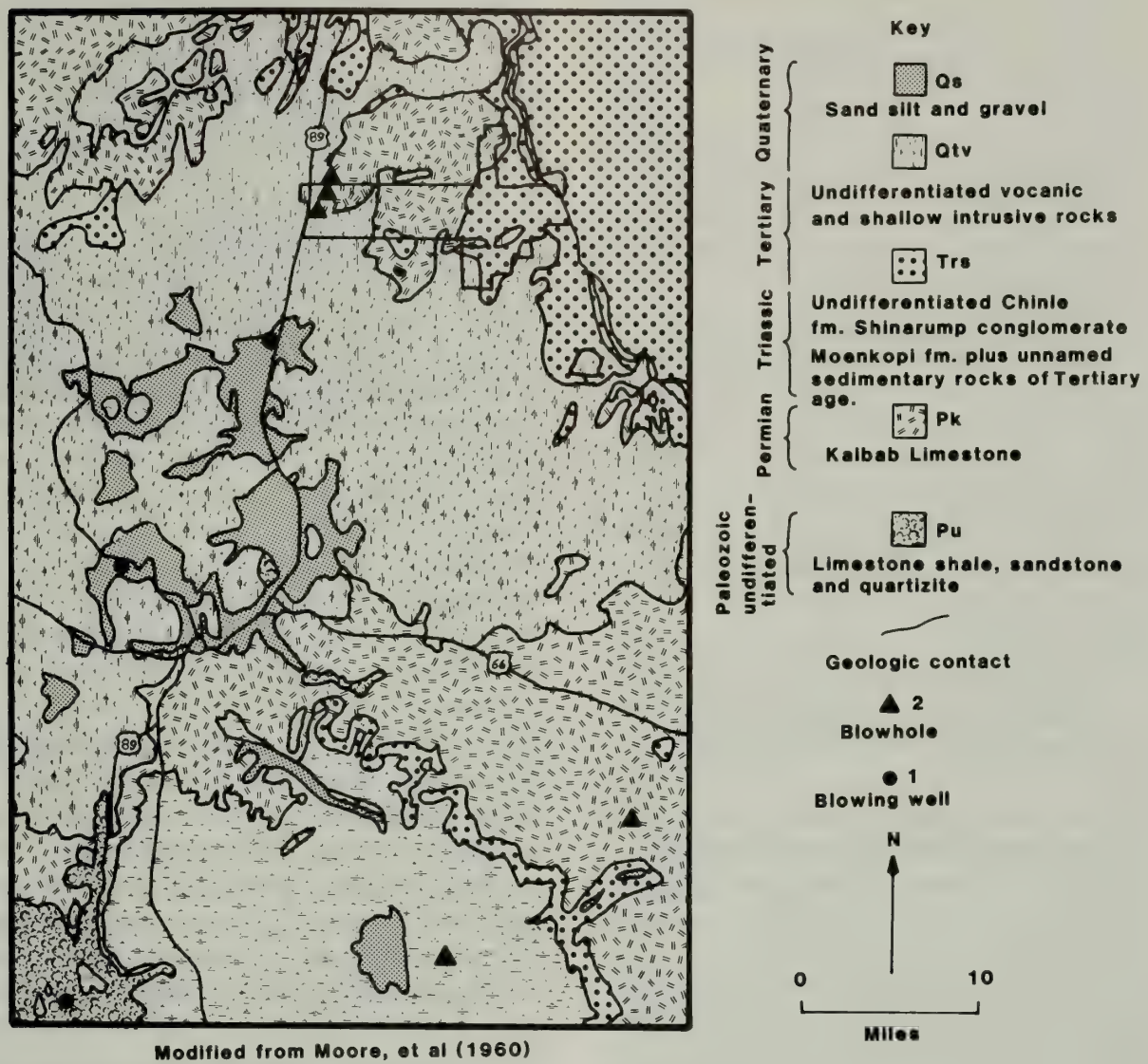


FIGURE 3.1. Generalized geologic map for Wupatki.

site number (WS-1603) and fully recorded (see Chapter 7).

Of equal interest, are the "blowholes" within the Kaibab Formation, which are associated with the earth cracks. There have been several studies of the blowholes and the associated phenomenon of active airflow (Schley 1961:105-111; Sartor and Lamar 1962:1-41; Miller 1962:1-32; Sartor 1964:26-34; Schley 1964:1-18; Lamar 1964:35-40). It was felt initally that the slowholes were tied to a cavity system, which may have been formed in part by solution action (Lamar 1964:40). They are actually small openings to buried earth cracks (Cave Research Foundation 1976:4). During the summer months, air generally enters the

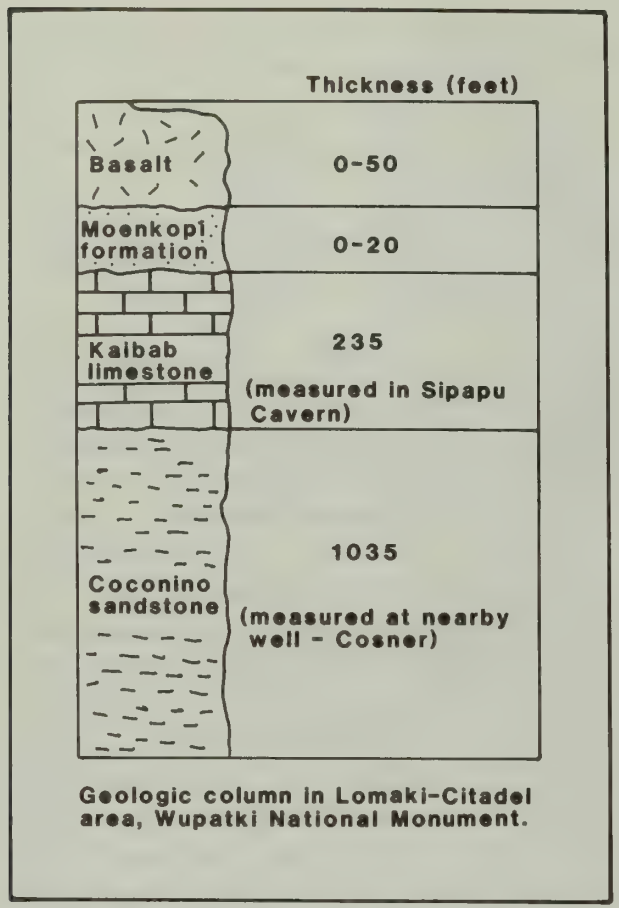


FIGURE 3.2. Geologic column cross-section.

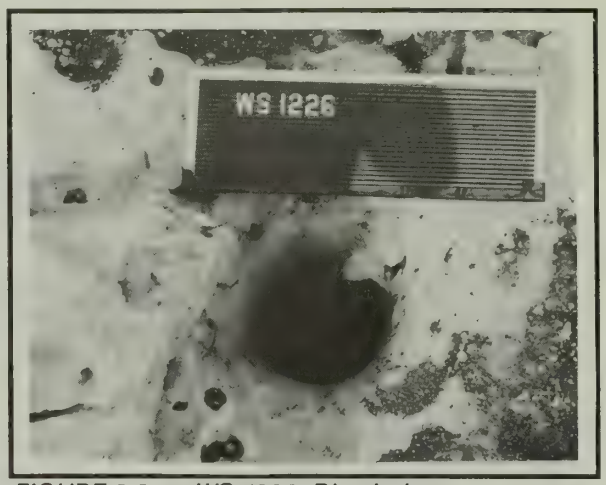


FIGURE 3.3. WS 1226, Blowhole.

blowholes during the late-night and early-morning hours, then this cool air is released during the hot afternoons (Sartor and Lamar 1962:18). Air contained in those nearly closed below-ground cavities requires much longer to adjust to changes in atmospheric pressure than would air in an open cavity (Schley 1964:9). Geological investigations were undertaken to locate and map all natural blowholes and breathing wells in the Wupatki area, with special reference to ground water (Miller 1962:1). This aspect will be discussed further in the section on hydrology in this chapter. It is felt that the blowholes have certain significance for the prehistoric people, given the proximity of archeological sites (Schley 1961:111). I would certainly agree that these geologic features--blowholes, earth cracks, and sinks--were important to the prehistoric populations, as they are for the modern Navajo and Hopi.

Next in the geologic sequence is the Moenkopi Sandstone Formation, which is Triassic in age (Chronic 1983:220). At Wupatki National Monument, the thickness of this red sandstone is only about 100 feet, with the upper portions removed by erosion (Brady 1935a:10). The softer shales and siltstones making up the Moenkopi Formation are more easily eroded than the underlying Kaibab Formation (Breed 1976:10). The Moenkopi Formation is comprised of three members, of which the lowest member is named the "Wupatki Member." The Moenkope Formation is composed of pale reddish-brown laminated sandstone (Stewart et al. 1972:23). This massive sandstone characteristically forms as a ledge and is named for exposures near Wupatki Ruin. The lower contact of the Wupatki Member is an unconformity with the Kaibab Limestone (Stewart et al. 1972:24). These Moenkopi siltstone exposures often show parallel ripple marks, probably the result of moderate currents that swept across Triassic

mudflats (Chronic 1983:220). Fossils within the Moenkopi Formation also suggest a shallow-water, tidal-flat, or near-shore situation (Stewart et al. 1972:71). Organic fossils (other than a few plant remains) are limited, but several vertebrate and invertebrate tracks have been located (Brady 1935a:11). Of particular interest are those tracks resembling the Cheirotherium tracks of the Lower Triassic in Europe (Brady 1935a:11; Peabody 1947:23-28; Breed 1976:9). One of these tracks found at Wupatki National Monument, probably belonged to a primitive group of reptiles from which crocodiles and dinosaurs eventually evolved (Brady 1935b:231). The conditions favoring the preservation of tracks were probably not conducive the preservation of skeletal remains (Colbert 1974:211).

Continuing along the geologic succession is the Chinle Formation, which overlies the Moenkopi but is not well defined within Wupatki National Monument. There are only small remnants of these shale deposits in the far eastern portion of the Monument, near the Little Colorado River. Across the river to the east, on the Navajo reservation, is Ward Terrace, which is near the top of the Chinle Formation (Vanderhoof 1934:36). Within the many multicolored scenic beds that make up the Chinle Formation, there are two outstanding characteristics: a great abundance of fossilized wood, and numerous bones of extinct reptiles and amphibians. These reptiles, amphibians, and numerous fishes from the Late Triassic illustrate a wet tropical environment now exposed in a desert region (Colbert 1972:1-11). While the Chinle Formation is hardly recognized within the monument boundaries, it certainly contributes to the scenic character of the surrounding area.

Further along the time sequence are the Pliocene and Pleistocene volcanic flows, ash flows, cinder cones, and other features related to volcanic activity. A classification of lava flows and cinder cones was utilized to discuss five stages of volcanic activity in the San Francisico Mountain area (Colton 1967). Stage I lava flows in the vicinity of Wupatki National Monument are the Black Point Flow, with a K-Ar date of 2.39 $\pm$ 0.32 million years; and the Citadel Flow (Colton 1967:16-17). Woodhouse Mesa flows date 0.79 $\pm$ 0.06 million years and are part of Stage II (Moore et al. 1974:474). A Pliocene drainage near Doney Crater, is blocked on the south by volcanics from Doney Crater (Breed 1969:177-181). Thus, Doney Crater,may be a Stage II-IV event (Breed 1969:181). Stage IV is represented best by S. P. Crater, west of the Monument boundary; and Black Falls on the east boundary (Colton 1967:31-33). The flow at Black Falls (Merriam Lava Flow) was dated by radiocarbon caliche at 5,600 years B.P. (Colton 1967:33). While S. P. Crater gives the appearance of a recent volcano, it is older than Sunset Crater. This is based mainly on the degree of erosion and weathering of the cones and the lava (Hodges 1962:15-35). A maximum age of 70,000 years has been suggested for the S. P. Crater Flow (Moore et al. 1974:480). Last in the sequence is the Sunset Age group (named after Sunset Crater eruptions), or Stage V (Colton 1967:35-36). Dating the eruption of Sunset Crater was an interesting and involved process that took several years to complete. One of the earliest references to the eruption date stated that it "took place some time after 700 and before 875 A.D." (Colton 1932a:584). To clarify this estimate, geological, typological, stratigraphical, and dendrochronlogical evidence was compared, and a date of 860 to 910 A.D. was suggested (McGregor 1936:15-26). This date was then revised, based on additional tree-ring evidence, and a date between 1046 and 1071 A.D. was given (Colton 1945:345-

355). In later reevaluations of tree-ring specimens from archeological sites near Sunset Crater, it was found that growth was "normal" through A.D. 1064 but that later growth was curtailed. This suggested that the eruption began after the growing season of A.D. 1064 and before the growing season of A.D. 1065 (Smiley 1958:186-190). On the strength of interpretation of additional tree-ring dates from a pithouse in Medicine Valley (NA1238), it was suggested that the eruption took place after the growing season of A.D. 1066 and before the growing season of A.D. 1067 (Breternitz 1967:73). In fact, there may have been two eruptions, one in A.D. 1065 and a larger one in A.D. 1067 (Breternitz 1967:72-76). In a 1977 report, following detailed geologic studies utilizing paleomagnetic measurements, it was shown that the eruptive history of Sunset Crater extended for a period of nearly 200 years (Shoemaker and Champion 1977). On the basis of field relationships and volcanic interpretation, six eruptive episodes have been identified and correlated with dendrochronology and paleomagnetism. These are: (1) deposition of extensive black scoria (beginning A.D. 1064-1065 and continuing to A.D. 1090 or later); (2) extrusion of the Kana-a Flow which was formed in A.D. 1064; (3) resumed or continued deposition and the Vent 512 Flow; (4) extrusion of early Bonito Flow (A.D. 1180); (5) continued construction of Sunset Crater with red scoria near the summit; and finally (6) extusion of the late Bonito and Kana-a flows and the formation of a small crater on the east side of the summit (Holm and Moore 1987:393-397). Thus, through continual evaluation, and the addition of new data, a fairly clear picture of Sunset Crater's eruptive history can now be presented.

During the Pleistocence there was some alpine glacation in the San Francisco Mountains (Sharp 1941:28-32). At that time, there may have been some increased deposition of glacial cobbles along the Little Colorado River from the increased flow of melting glaciers (Bartlett 1943:267). Today lag gravels form a desert pavement near the Little Colorado River drainage (Breed et al. 1984:366). The individual stones within this pavement are often found with a patina of desert varnish or are highly polished by windborne abrasives (Breed et al.1984:367). These pavements of stones along the alluvial terraces served as "quarries" for stone tool manufacturing (Bartlett 1943:266). The cultures represented were called the "Tolchaco Focus" (Bartlett 1942:37). That concentration of stone along the terraces of the Little Colorado River offers the only good flaking material for many miles of sedimentary deposits to the north and east (Bartlett 1980:92).

To summarize the importance of geologic aspects at Wupatki National Monument, the available formations provided a source for building materials, clay for mortar and ceramics, lithic tools, and a place for rock art development. Moenkopi Sandstone makes an excellent building stone and has been quarried near Flagstaff (Brady 1935a:12). Quarry areas have also been located within Kaibab limestone and basalt areas at Wupatki (see Chapter 2). The desert pavement areas on the terraces above the Little Colorado River no doubt provided a lithic procurement source for several centuries (see Chapter 7). Probably most of the obsidian utilized came from the San Francisco volcanic field, and predominately from Government Mountain (Jack 1971:103-114). Clay sources could not definitely be determined during the survey, but it seems likely that the Little Colorado River and numerous reservoirs and also natural catchments provided excellent source areas. John Stein constructed and fired a ceramic vessel made of clays col-

lected from the Little Colorado River in 1985. In open-air rock art sites, the geology also becomes part of the cultural landscape (see Chapter 9).

Soils

Closely associated with the geology are the many soil types that have been weathered from the rocks and minerals available. Factors affecting the soil forming process are parent materials, climate, vegetation, topography, and time (Fuller 1975:36). Nutrients for plant growth must also be obtained from the soil. Several important nutrients are nitrogen, phosphorus, sulfur, potassium, calcium, and magnesium (Dean 1957:80-85). Many desert soils high in calcium carbonate (caliche) will form a hardpan, making it difficult for plant roots to penetrate this surface (Fuller 1975:62-66). Good soil aeration favors the release of nitrogen from the soil organic matter, but western desert soils tend to be generally low in nitrogen (Allison 1957:85-94). Crop yields are determined more by soil nitrogen than by other mineral elements supplied by the soil. Many soils of the Southwest are developed from wind - or water-deposited materials, Wind-laid (eolian) materials can include loess, sands (forming dunes), and volcanic ash, Water-laid materials (alluvium) are generally confined to streams, rivers, arroyos, and arroyo fans (Fuller 1975:37).

Two soil surveys have been conducted for Wupatki National Monument. The first was a special report prepared by the U.S. Department of Agriculture, Soil Conservation Service, for the U.S. Department of Interior, National Park Service, in 1971. This study concentrated on a soil survey, range site, and range condition inventory for Wupatki. Although the emphasis of the report was to develop better management for the range conditions within the Monument's boundary, the soils maps are useful in understanding variations throughout Wupatki. These maps were utilized for the discussions of prehistoric agriculture (Chapter 4).

The area within which the Wupatki National Monument lies is in the Grand Canyon section of the Colorado Plateaus physiographic province. It is an area of high plateaus, mesas, plains, breaks, canyons, and valleys. Elevations on the Monument range from 5720 feet in the southwest corner of the Monument near Highway U.S. 89 to 4280 feet on the Little Colorado River on the northeast corner. Gently sloping to steep plains on basalt bedrock are found in the west end of the Monument west of Citadel Ruin. The central part of the Monument from Citadel Ruin eastward to Doney Cliffs are on almost level plains on limestones of the Kaibab formation. Drainage is east and northeastward to the northward flowing Little Colorado River.

> Soils in the basalt areas are on gently sloping to steep slopes and are shallow to moderately deep. Basalt rock outcrops are common on the steep slopes and cliffs. Cinders blown from nearby volcanic cones and drifted by the wind have formed a thin mulch over much of the area of the Monument. Locally, wind action has formed drifts more than one foot thick. The limestone areas have shallow and very shallow soils over bedrock. The sandstone and shale areas are quite complex in slope, usually have thin soils and are influenced by cinders in many places (Schurig 1971:1).

A more complete breakdown of the various soil units discussed in the 1971 report will follow in Chapter 4 of this volume.

The second soil survey was conducted by the Soil Conservation Service in 1972-

1979 and published in 1983. This report, entitled Soil Survey of Coconino County Area, Arizona, Central Part, formed the basis for Fig. 3.4.

Sixteen soil types were found at Wupatki (SCS 1983:9-60). The Epikom-Rock Outcrop soil unit is located in areas of mesas and slopes of 15 to 60 % and the soil is shallow and well drained. Winona Stoney Loam refers to a soil unit which has very shallow, welldrained soil formed from limestone and calcareous sandstone. The Winona Gravelly Loam unit is very similar to the soil unit above, with only moderate permeability due to the shallow nature of the soil. Badland-Torriorthents refers to a soil unit on hillsides and mesas where the slope is 0-60. It occurs in severely eroded areas. This soil unit occurs in an area with very limited rainfall and sparse vegetation. Tuweep Gravelly Loam is a deep, well-drained soil formed in alluvium derived from basalt. It occurs on plateaus and fairly flat areas. The Lomaki-Nalaki Cindery Loam is generally found on fan terraces and is deep and well drained. There is often a cemented hardpan below this soil unit, but the effective root depth is 40 to 60 inches. The Epikom Complex is composed of fine sandy loam, which is shallow and well drained. The next unit occurs on hillsides and is called the Winona-Rock Outcrop. It is primarily exposed limestone. A large portion of Antelope Prairie is composed of the next soil unit, Aut Gravelly Loam. It has a rooting depth of approximately 20 to 40 inches, and runoff is slow. Epikom Cindery Loamy Sand is located on fairly flat areas formed in alluvial and eolian deposits. Next is a sandy loam soil unit called the Tours-Ives Association, located near the Little Colorado River. Wukoki-Wupatki Cindery Loam is generally located on fan terraces at the foot slopes of cinder cones It is very shallow because it is formed of pyroclastics. The Wukoki-Rock Outcrop unit is also formed on fan terraces and hillsides with exposed basalt outcrops. Within much of the Wupatki Basin is the next unit, Ashfork Gravelly Clay Loam. This soil unit is formed in alluvium and colluvium derived from basalt and ash. Closely comparable to it is Wukoki-Wupatki Cindery Loam. The only differences are that this unit is found mainly on hillsides, and the percentage of Wukoki Loam is greater. Finally, the Paymaster-Lynx Association is very rarely found in Wupatki National Monument. This unit is found on long, narrow stream terraces and has a deep rooting depth. This brief description of the soils can be compared with the vegetation map (see the section on flora in this chapter). The two studies mentioned above are comparable, except that the 1983 study put more emphasis on elevation and slope.

Following the eruption of Sunset Crater, there was a thin cover of black volcanic ash and cinders over the greater area. This created a moisture retention quality, which allowed for agricultural use (Colton 1932a:589; Colton 1946a:311; Colton 1960:9; Schroeder 1977:33; Downum 1988:179-189). Ironically, the volcanic ash also served as a partial explanation for the abandonment of the area. It was felt that wind action removed much of the ash, causing the fields to then become nonproductive (Colton 1960:13-14; Downum 1988:190-194). Another suggestion was that the soil became depleted of nutrients essential for the crops (Berlin et al. 1977:588-600). To better understand some of these relationships, careful collection of additional data is suggested. Testing of maximum cinder depth required for corn growth is needed. Chemical analysis of various known field systems should be done. Finally, pH analysis should be done in some of the field areas. While these studies may not offer

FIGURE 3.4. Wupatki Soils Zones.

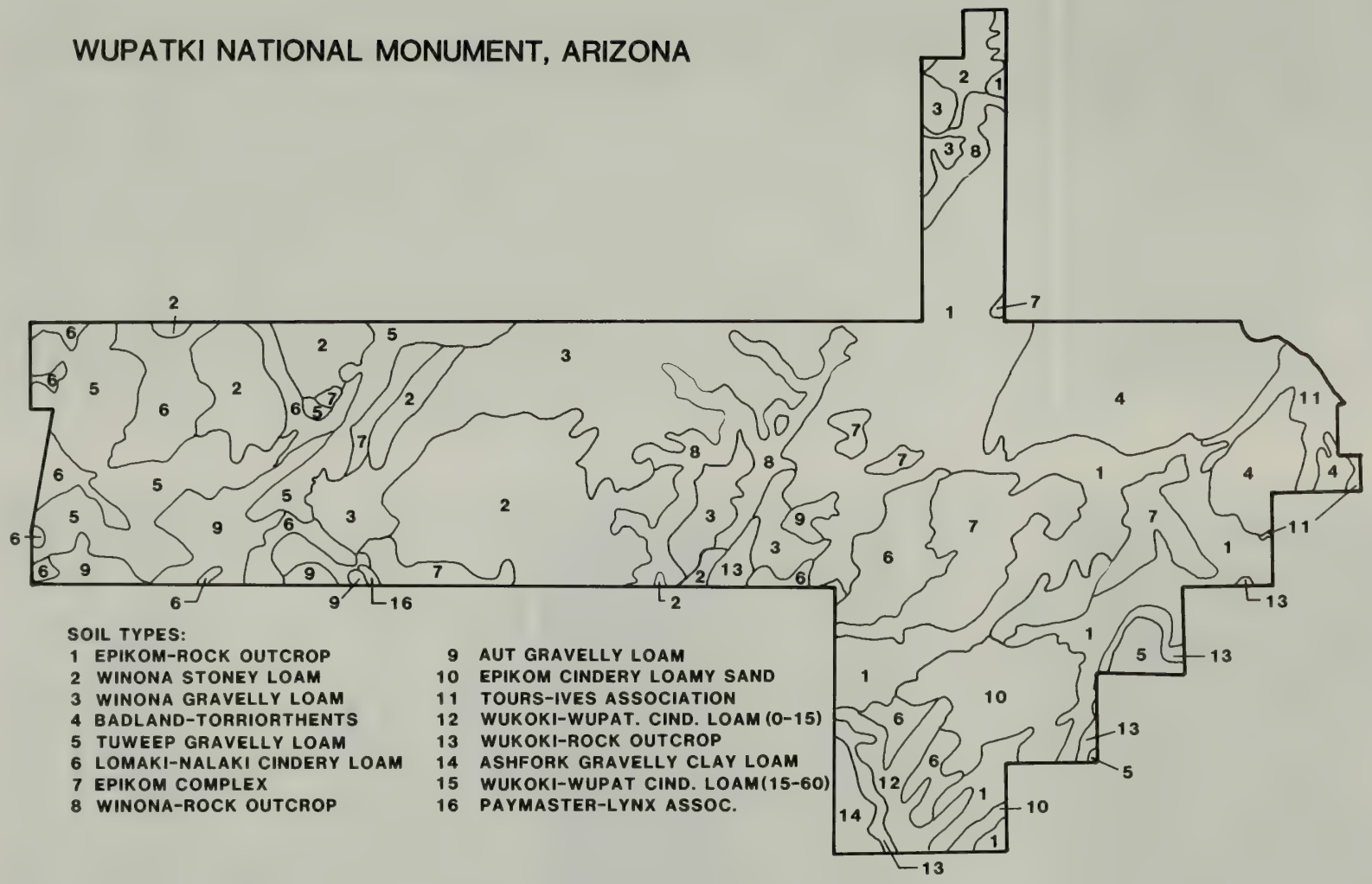


FIGURE 3.5. WS 907, Alignments in the cinders.

FIGURE 3.6. Antelope Prairie with the San Francisco Peaks in the background.

answers, they can help provide a clearer picture agricultural usage and reasons for abandonment.

Climate

To approach an understanding of climate at Wupatki National Monument, some of the problems and questions involving both modern and past climates need to be explained for the region. First, present-day climatic situations will be described.

FIGURE 3.7. The Wupatki Basin.

Then, some attempt to reconstruct past climates will be made. Unfortunately, at this time, a large portion of this section is conjectural. Much more work is needed to better refine the Wupatki climatic story.

Much of Wupatki is designated as a Saltbush climatic zone, a division of the Upper Sonoran zone (Stanislawski 1963:13). Much of the precipitation comes from convection storms from the Sonoran summer monsoons, and winter frontal storms from southern California (Jameson 1969:110). Most of the rainfall occurs during July and August, with very limited snowfall occurring in the winter months. Six inches of snow is considered a major fall at Wupatki (Stanislawski 1963:13). Weather records at the Wupatki Visitor Center from 1951 are maintained by the National Oceanic and Atmospheric Administration. The precipitation records show that during a 35 - year span, from 1951 to 1986, precipitation averaged from 4.6 inches in 1968 to 13.8 inches in 1972 and 1983 (Wupatki Records 1986). The temperature ranged from an average of +35.2 F. in January to +79.9 F. in July (NOAA 1975). Temperatures have been recorded to +110 F. in July. Winds, generally most intense in

the spring, flow from the west or southwest (Stanislawski 1963:13). The number of frost-free days generally exceeds 180 (Stanislawski 1963:14; Ritterbush 1984). The San Francisco Peaks southwest of the Monument, provides an effective rain-shadow over most of the area (Cinnamon 1988:9). The bulk of the available precipitation occurs in the highlands (Antelope Prairie area) on the west, with only limited moisture reaching the Wupatki Basin area (near the Little Colorado River) to the east (see Chapter 4 for a discussion of how this effects prehistoric agriculture). May and June are the driest months throughout the state of Arizona (Green and Sellers 1964:34). This factor can be critical for the germination of domestic crops.

To better understand the rainfall patterns around Flagstaff, a series of thirteen rain gauge stations were established and monitored from 1932 to 1956 (Colton 1958:3-17). Three stations were established at Wupatki: Citadel Ruin (elevation 5,400 feet), Wupatki Ruin (elevation 4,961 feet), and Black Falls (elevation 4,300 feet). The annual precipitation averaged 11.40 inches at the Citadel, 6.97 inches at Wupatki, and 6.44 inches at Black Falls. Over the 25 years, Citadel ranged from 6.42 inches in 1939 to 24.10 inches in 1955, Wupatki ranged from 3.73 inches in 1938 to 11.54 inches in 1941, and Black Falls ranged from 4.07 inches in 1950 to 12.88 inches in 1941. One of the wettest years ever recorded in Arizona, was 1941 (Green and Sellers 1964:21). This illustrates that there is a much higher amount of rainfall in the western portion of the Monument. During the summer monsoon season, most of the rainstorms move across this part of the Monument, and rarely occur in the basin.

There are many conflicting views and ideas when the subject of climatic reconstruction is pursued. Following the eruption of Sunset Crater, the cinders may have allowed for ground water to build up, and the trapped water formed springs, lakes, ponds, and flowing streams (Schroeder 1977:33). There may also have been increased precipitation from volcanic ash the clouds following the eruptive cycles. What this suggests is that rainfall is much less today than it was during the height of prehistoric occupation at Wupatki, and the now-dry springs and streams are an indication of this factor (Colton 1960:23). After A.D. 1150, many areas of the Colorado Plateau were abandoned, and populations then concentrated in well-watered areas in a few lowlands (Euler et al. 1979:1091). There was a relatively brief deterioration of hydrologic conditions at this time, accompanied by a major dendroclimatic drought in the last part of the 1100s century (Dean et al. 1985:543). These major climatic changes may have been a greater factor than eolian deflation of the cinders, suggested by Colton (Hevly et al. 1979:504-510). Prior to A.D. 1150, moisture was distributed in the middle and late summer months, and it then changed to a winter, spring, and early summer distribution. This factor could account for considerable reduction in crop production. If this is the case, there may not have been a great reduction of annual precipitation, but moisture was not available when it was most greatly needed.

One of the most important tools for climatic reconstruction in the southwestern United States is dendrochronology. Tree-ring data are reliable indicators of environmental changes because of their high temporal resolution and their strong correlation with climatic variability (Dean et al. 1985:541). There is, however, not a perfect correlation between tree growth and climate: "Tree-ring records are better predictors of low precipitation values than of high ones because low effective moisture

FIGURE 3.8. Coring wood from Navajo hogans to better date the structure.

inhibits growth directly by constraining the physiological processes of trees" (Dean 1988:134). Dendroclimatology provides the most direct and highest resolution for reconstruction of past environmental conditions. Climatic conditions (both temperature and precipitation) influence the growth of rings primarily through photosynthesis and the accumulation of stored food (Fritts 1965:427). In general it is inferred that the wider the ring, the moister and cooler the climate, but different tree species and elevational variations can produce somewhat different measurements. Several sources of variation exist for Flagstaff tree-ring data: environmental variation, variation in the datability of tree species, prehistoric behavior involving the use of wood, formation processes and postdepositional events, and archeologists' behavior (Ahlstrom 1990). Wupatki has several dates from beams of ponderosa pine, white fir, and Douglas fir, and these now nonlocal species suggest evidence of climatic change (Ahlstrom:7-8). Even more likely, these beams were imported in from environments that do not reflect the local climatic conditions. An attempt was made to develop a juniper chronology from Navajo sites, cores from living trees, and sections of cut stumps. This could not be accomplished because of erratic rings, which could not be cross-dated with the existing conifer series (Cinnamon 1988:29).

Other attempts at paleoclimatic reconstruction at Wupatki have been limited. Woodrat middens had no dated materials from the period of prehistoric occupation (A.D. 1100 to 1250) (Cinnamon 1988:33-35). Alluvial stratigraphy and geomorphology are very difficult to interpret for the Wupatki area, because many of the drainages are now filled with deposists of cinders. Some work to define twentieth-century processes and the influence of climate along the Little Colorado River is ongoing (Hereford 1984). More work is needed on climatical effects of alluvial deposits dating from A.D. 1000 to 1300 in the Wupatki area. "The combined effects of population growth and shifts in climatic conditions provide a powerful framework for explaining culture change among prehistoric societies" (Larson and Michaelsen 1990:244). What is required are processes to better understand the prehistoric climate at Wupatki and clarify some of the of previous interpretations.

Hydrology

When most visitors at Wupatki National Monument look out over the sparse landscape, they frequently ask where the prehistoric inhabitants found water. The rhetorical answer is "from nearby seeps and springs" (Cinnamon 1984:1). All of the known springs are at the base of Woodhouse Mesa near Wupatki Ruin, so the answer is appropriate for that site. This does little to satisfy the question of water needs for the inhabitants of Antelope Prairie or Hull's Wash in the western portion of the Monu-

ment, where site density is high. Those who lived in sites along the eastern portion of the Monument, near the Little Colorado River, could have utilized permanent water from the river, but here site density is very low. How did prehistoric peoples exist in the western portion? Chapter 2 listed a number of water control and collection site types: dams and reservoirs, catchments, check dams, and springs. By discussing all of these features more, possibly a clearer picture can be presented. Eight dams and reservoirs, 19 catchments, 55 check dams, and 3 springs were listed in Table 2.1.

Dams and Reservoirs

As was already mentioned in Chapter 2, both prehistoric and historic dams were constructed in small drainages for the accumulation and holding of water. Periodic maintenance would have been required to repair washed-out and gullied spots, remove silt, and clear the edges of brush and weeds (Turney 1985:45). It is quite probable that the wet clay and silt, which was removed during this maintenance process, was utilized for mortar in dam reconstruction, other building construction, and ceramic manufacture. Generally there are two inferred uses for water stored in these basins--domestic water supply and irrigation (Crown 1987:217). Crown defines reservoirs as "features to store water diverted from a natural source by artifical ditches or canals." A "reservoir" at Wupatki is more like what Crown defines as a "catchment basin" which is used to retain water in surface drainages. Another term for these features could be "water storage basins". "Water storage basins are defined as human-made or human-modified depressions designed to hold water for an extended period" (Scarborough 1988:22). Such basins could be filled and discharged through a canal system or filled by surface runoff. Two of these features were tested at Wupatki: WS-165 and WS-224 (Ritterbrush 1984). It was hoped that all of the "reservoirs" could be carefully mapped and volume estimates obtained from each one. This could then give some idea of the maximum population drawing upon this limited resource (Scarborough 1988:23).

Catchments

Several small natural basins and playas hold water during the rainy season. These catchments would be very similar to what Crown calls a "retention basin" (1987:212-213). The difference is that no constructed dams or spillways are visible with these features. It is quite possible that catchments were cleaned occasionally, much like reservoirs. Most of these features are found within shallow soils on Antelope Prairie and are used as water holes for animals in the area today. As was discussed in Chapter 2, there are pueblos located near many of these natural catchments, which suggests they may have been utilized as water sources. A problem with these shallow basins is that they rapidly lose water by evaporation and seepage (Turney 1985:45).

Checkdams

There are 55 checkdams located throughout Wupatki National Monument. As was discussed in Chapter 2, these features were utilized mainly to curb erosion. It has been suggested crops were planted behind these features, but this does not appear to have been their main function (Doolittle 1985:287-289). These water control features were not employed to a great extent prior to the A.D. 1100s due to the

built-in moisture conservation of the cinders (Schroeder 1977:54-55). With the loss of some of the cinder cover due to wind and water action, these features were constructed, probably to curb further erosion, after it started to get drier (ca. A.D. 1125).

Springs

In addition to the three springs mentioned in Chapter 2, there is Coyote Spring, south of the monument Boundary, which produced 1,032.43 gallons per day in 1935 (Brewer 1935a:106). Also,two small seeps were located in 1984 (Cinnamon 1984). All of the springs are located on the east edge of Woodhouse Mesa and issue from the Moenkopi Formation (Christensen 1982:72). Wupatki Spring stopped flowing in the 1950s, and possibly this may have happened prehistorically also, causing the inhabitants to abandon Wupatki Pueblo (Cinnamon 1984). Fluctuations could have been the result not only increases or decreases in the groundwater supply, but also of minor earth tremors associated with volcanic activity. Wupatki Ruin was probably abandoned by A.D. 1220, about the time that Sunset Crater ceased to be active. The numerous earth cracks, fissures, and cavities underlying Wupatki could also have greatly affected spring flow in the area (Miller 1962:24).

Variability of water control systems is clearly a behavioral response to local environmental influences (Plog and Garrett 1972:282). The deterioration of the climate in the late A.D.

1100s appears to have placed the Kayenta Anasazi under various social and natural environmental stress (Lindsay 1970). If there was more than adequate rainfall prior to the mid-1100s at Wupatki, water conservation may have not been necessary. When the climate changed and the area became much drier, there must have been an emphasis on water preservation and water control for survival. Because the Little Colorado River contains high amounts of dissolved salts and gypsum, it may not have been a desirable source (Chronic 1983:221). A series of droughts beginning in the 1200s could have created prolonged or permanent water shortages and forced migration out of the area (Schroeder 1977:58). While it is impossible to estimate exactly how much water was required for survival prehistorically, 1 to 1 3/4 gallons per capita per day seems reasonable (Turney 1985:46-47). Other methods for collecting water included placing jars under ledge overhangs to collect the runoff (Schroeder 1944). Quite possibly, runoff from the roofs of the dwellings and snow for melting was also collected by the prehistoric populations. This need for water for domestic use may have been the greatest limiting factor for existence in the early 1200s at Wupatki.

Flora

Several major contributions have been made to the study of the flora of Arizona and Wupatki National Monument, the most noteworthy of which are Kearney and Peebles (1951), Humphrey (1977), Parker (1972), McDougall (1962), and Green and Rominger (1976). These studies were utilized to formulate the vegetative base map for Wupatki National Monument, and for the vegetation information section on the survey forms (see Figure 3.9). For a complete checklist of the vascular plants of Sunset Crater and Wupatki national monuments, see Appendix A of Bateman (1976). A total of 351 species have been

reported for both monuments (Green and Rominger 1976:II-3-II-25). There are three main plant communities at Wupatki: Grassland (about 37%); Juniper-Grassland (about 9%); and Cold Desert Shrub (about 54%), found mainly in the eastern portion of the Monument. The Cold Desert Shrub community was further divided into five subdivisions "based on the homogeneity of the floristic composition of the area." Four species of plants are listed as "threatened": Amsonia peeblesii, Phacelia serrata, Phacelia crenulata, and Astragalus lancearius (Bateman 1980:I-4-I-8). Amsonia is noted as occurring at five locations in Wupatki National Monument. A sixth area located by the archeological survey crew in 1985 in the NE 1/4 of Section 18, T.25N, R.10E, also had extensive stands of this species. One other rare species, Oensthera boothii, is found at only one limited area in Wupatki. These studies have been utilized for baseline data, and any additional biological studies in the future will be greatly aided by this research.

In this section, instead of restating the studies mentioned above, I wanted to consider those plants which may have been utilized by prehistoric populations of people in the Wupatki area. In the discussion of the environmental setting at NA2077 (WS-1405), it is stated, "Of the twenty-five most common plant forms, fourteen could have been utilized for food" (Ward 1978:136). Because all of the baseline information outlined above was not available to the author, four of the species he lists were not found at Wupatki. To provide a current listing, I went through the checklist prepared by James M. Rominger (Bateman 1976:Appendix A) and found that of the 240 species listed for Wupatki National Monument, about half (122 species) could have been culturally utilized. The following list of these 122 species presents the scientific name, the common name (when known), possible/probable use, and sources describing the cultural usage of these plants (Table 3.1).

Three other wild plants not on Rominger's checklisth are important to the Wupatki area and Juglans major (walnut), Feltis reticulata (hackberry), and Symphoricarpus spp. (snowberry). Walnuts were sought for food (Gasser 1982a:27), and living trees have been recently located at Wupatki (Cinnamon, personal communication 1986). A walnut shell was excavated from Room 7 at Wupatki Pueblo (Reed and Brewer 1937:16). Some remains of hackberry have been found in pack-rat midden materials from Wupatki National Monument (Cinnamon, personal communication, 1986), but no plants have been located presently on the Monument. There are some limited stands of snowberry on the Monument (Cinnamon, personal communication, 1986), which may have been used for medicinal purposes (Sweet 1976:27).

The dependence on nondomestic plants has been discussed and documented within the archeological record (Ford 1979:321; Woosley 1980:321; Gasser 1982a:25). As is indicated above, 51 of the 122 culturally utilized plants could have been used as food. This, however, does not negate the importance of domesticated plants to the prehistoric people living at Wupatki and their commitment to agricultural activities. Before discussing the domesticated plants grown at Wupatki, I would like to consider two plants that occur archeologically at Wupatki Pueblo (but are not common to the area), which were porbably obtained by trade, exchange, or redistribution. Generally, when redistribution is discussed, food exchange during times of low productivity is the primary factor considered (Lightfoot 1979:319-339). These two plants, Martynia

TABLE 3.1. Plants which had cultural use.

Scientific Name	Common Name	Possible/ Probable Use	Reference
1. *Pinus edulis*	Pinyon Pine	Food source (nuts), firewood, additional uses from the pitch and resin (medicine and water proofing material and building material.	Minnis 1984:6; Gasser 1982a:23-24; Harrington 1972:96-99; Whiting 1939:63; and Stevenson 1915:57 & 70.
2. *Juniperus monosperma*	One-seed Juniper	Food source (berries), firewood, medicine, and building material.	Gasser 1982a:27; Whiting 1939:62; and Stevenson 1915:55.
3. *Ephedra viridis* 4. *Ephedra viridis* var. *viscida*	Mormon Tea, Jointfir, or Jointpine	Medicine, food source (seeds), and as a beverage.	Harrington 1972:133-135; Sweet 1976:22; and Whiting 1939:63-64.
5. *Ephedra torreyana*	Mormon Tea		
6. *Aristida fendlexiana* 7. *Aristida longiseta*	Three-awn Grass	A bunch grass (Unknown if the fruit may have been eaten).	Whiting 1939:64.
8. *Bouteloua curtipendula*	Side-oats Gramma	Good for grazing animals and used in the fill of basketry.	Whiting 1939:64 and Stevenson 1915:83.
9. *Bouteloua riopoda*	Black Gramma		
10. *Bouteloua gracilis*	Black Gramma		
11. *Oryzopsis hymenoides*	Indian Millet, Indian Rice Grass, Sand Bunch Grass	Food source (seeds).	Gasser 1982:27; Harrington 1972: 130-133; and Whiting 1939:65.
12. *Phragmites communis*	Reed, Carrizo	Possibly used for arrow shafts, roofing, pipe stems, tubular pipes, weaving rods, and flutes.	Castetter and Bell 1942:113, and Whiting 1939:66.
13. *Sitanion longifolium*	Squirrel Tail?	Unknown	Whiting 1939:66.

TABLE 3.1. (continued).

Scientific Name	Common Name	Possible/ Probable Use	Reference
14. *Sporobolus airoides* 15. *Sporobolus flexuosus* 16. *Sporobolus giganteus*	Alkali Sacaton Dropseed Giant Dropseed	All bunch grasses which were used as a food source (seeds).	Gasser 1982a:27, and Whiting 1939:66.
17. *Stipa comata*	Needle-and-Thread Grass	Unknown	Whiting 1939:66.
18. *Yucca angustissima*	Narrow-leafed Yucca, Soapweed	Food source (flowers and fruits), soap (roots), cordage and basketry (leaves).	Minnis 1984:7; Gasser 1982a:24; Harrington 1972: 103-108; Baldwin 1940:26-27; Whiting 1939:71; and Stevenson 1915:79, 82 & 83.
19. *Populus fremontii*	Cottonwood	Food Source? (berries are chewed as gum), firewood, building material, making of drums, boxes, and kachinas.	Whiting 1939:71-72.
20. *Salix scouleriana*	Willow	Firewood, building material, basketry, and making prayer sticks - may have been used as arrow shafts?	Baldwin 1940:26; Whiting 1939:72; and Stevenson 1915:70.
21. *Phoradendron juniperinum*	Juniper Mistletoe	Used medicinally.	Whiting 1939:72.
22. *Eriogonum aureum* 23. *Eriogonum corymbosium* 24. *Eriogonum corymbosium var. glutinosum* 25. *Eriogonum deflexum* 26. *Eriogonum divaricatum* 27. *Eriogonum hookeri*	Buckwheats	Possibly used medicinally (for menstruation and to expedite childbirth), and for ceremonial use by Zuni.	Stevenson 1915: 49, and Whiting 1939:73.

TABLE 3.1. (continued).

Scientific Name	Common Name	Possible/ Probable Use	Reference
28. Eriogonum inflatum 29. Eriogonum jonesii 30. Eriogonum leptocladon 31. Eriogonum racemosum 32. Eriogonum wetherillii			
33. Atriplex canescens	Fourwing Saltbush	Firewood, ashes used in piki, and as a Kiva fuel.	Whiting 1939:73, and Stevenson 1915:44 and 88.
34. Atriplex confertifolia	Saltbush, Shad Scale	Food source (seeds and leaves), and as a medicine.	Sweet 1976:27, and Whiting 1939:73.
35. Chenopodium album 36. Chenopodium fremontii 37. Chenopodium graveolens 38. Chenopodium hians 39. Chenopodium leptophyllum	Goosefoot, Lambsquarters, Pigweed, and Sowbane	Food source (seeds for meal, and leaves for greens), and as a possible medicine.	Minnis 1984:7; Gasser 1982:27; Sweet 1976:48; Harrington 1972: 82-84; Whiting 1939:73-74; and Stevenson 1975: 66.
40. Eurotia lanata	Winter Fat, Winter Sage	Used for a fever medicine, root used as a burn remedy.	Whiting 1939:74; and Stevenson 1915:51.
41. Sarcobatus vermiculatus	Greasewood	Used for firewood, making rabbit sticks, planting sticks, is the main kiva fuel, and is used for arrows (possibly also for construction).	Whiting 1939:74.
42. Amaranthus albus 43. Amaranthus graecizans	Pigweed, Careless Weed	Food source (seeds made into meal and leaves and stems cooked like spinach), also sometimes eaten raw.	Minnis 1984:7; Gasser 1982a:27; and Harrington 1972:68-71.
44. Abronia elliptica	Sand Verbena	Medicine used to induce sleep.	Whiting 1939:75.

TABLE 3.1. (continued).

Scientific Name	Common Name	Possible/ Probable Use	Reference
45. *Tripterocalyx micranthus*	Four-o'clock	Medicinal purposes (for snakebite and for swollen throat glands).	Stevenson 1915: 61.
46. *Portulaca mundula* 47. *Portulaca retusa*	Purslane, Portulaca	Food source (seeds made into meal and leaves and stems cooked like spinach), also sometimes eaten raw.	Minnis 1984:7; Gasser 1982a:27; and Harrington 1972:79-81.
48. *Arenaria eastwoodiae*	Sandwort	Used medicinally as a stomach relief.	Whiting 1939: 75-76.
49. *Descurainia pinnata*	Tansy Mustard	Food source (greens).	Gasser 1982a:26, and Whiting 1939:77.
50. *Dithyrea wislizeni* 51. *Lesquerella arizonicum*	Spectacle Pod	Used as a medicine.	Whiting 1939:77, and Stevenson 1915:48-49.
52. *Lesquerella intermedia* 53. *Sisymbrium altissimum*	Bladderpod	Used as a medicine (for snakebite).	Whiting 1939:77.
54. *Stanleya pinnata* 55. *Streptanthella longirostris*	Prince's Plume	Food source (greens) and as a medicine (for syphilis).	Gasser 1982a:26; Whiting 1939:77; and Stevenson 1915:60.
56. *Cleome serrulata*	Rocky Mountain Beeweed	Used as a food source (greens) and for the manufacture of prayer sticks and pottery paint.	Gasser 1982a:27; Martin and Sharrock 1964: 176-177; Whiting 1939:77-78; and Stevenson 1915: 69 and 82.
57. *Fallugia paradoxa*	Apache Plume	Stems used for arrows.	Whiting 1939:78.
58. *Ribes cereum*	Wax Current	Possible food source (berries).	McDougall 1962: 31.

TABLE 3.1. (continued).

Scientific Name	Common Name	Possible/ Probable Use	Reference
59. Astragalus amphioxus 60. Astragalus episcopus 61. Astragalus humistratus 62. Astragalus lanclarius 63. Astragalus lentiginosus 64. Astragalus praelongus 65. Astragalus recurvus 66. Astragalus tephrodes 67. Astragalus wootoni	Milkvetch, Rattleweed, Loco Weed	Used for medicine and as a possible food source (roots of A. ssp.)	Sweet 1976:50, and Whiting 1939:79-80.
68. Dalea terminalis	Parosela	Used as a medicine and as a food source for children (roots).	Sweet 1976:22, and Whiting 1939:80.
69. Parryella filifolia		Used for making baskets.	Stevenson 1915: 81 and 85.
70. Phaseolus angustissimus	Wild Bean	Folk-lore use for making boys strong.	
71. Tribulus terrestris	Caltrop	Unknown	Whiting 1939:83.
72. Croton texensis		Used as a medicine.	Whiting 1939:84.
73. Euphorbia serpyllifolia		Used as a medicine and as a sweetener.	Stevenson 1915: 51 and 67-68.
74. Rhus trilobata	Squaw Bush	Used as a medicine, dye and as a drink (berries). Twigs are used for firewood, basketry, and as a kiva fuel.	Sweet 1976:28; Whiting 1939:84; and Stevenson 1915:81.
75. Sphaeralcea grossulariaefolia 76. Sphaeralcea leptophylla 77. Sphaeralcea parvifolia 78. Sphaeralcea subhastata	Globe Mallow	Used as a medicine.	Whiting 1939:85.

TABLE 3.1. (continued).

Scientific Name	Common Name	Possible/ Probable Use	Reference
79. *Echinocereus fendleri*	Hedgehog Cactus	Used as a food source (fruit).	Minnis 1984:6, and Whiting 1939:85.
80. *Opuntia macrorhiza*	Cactus	Used as a food source (fruit) and as a medicine (roots).	Minnis 1984:6; Gasser 1982a:24; Harrington 1972: 123-127; Whiting 1939:86; and Stevenson 1915:69.
81. *Opuntia whipplei*	Cholla Cactus, Cane Cactus		
82. *Gaura coccinea*	Evening Primrose Family	Possibly used as a medicine for snake-bite.	Whiting 1939:86.
83. *Cymopterus bulbosus*	Carrot Family	Possibly used as food source (leaves and roots).	Sweet 1976:43.
84. *Cymopterus multinervatus*			
85. *Cymopterus purpurascens*			
86. *Forestiera neomexicana*	Ironweed	Used to made digging sticks.	Whiting 1939:87.
87. *Asclepias involucrata*	Milkweed	Used as a food source (greens) and as a medicine.	Sweet 1976:50; Harrington 1972: 55-58; Whiting 1939:87; and Stevenson 1915: 65.
88. *Asclepias latifolia*			
89. *Asclepias subverticillata*			
90. *Gilia longiflora*	Blue Gilia	Used as a medicine (mainly for headaches and stomach-aches).	Whiting 1939: 87-88, and Stevenson 1915: 52.
91. *Gilia multiflora*			
92. *Nama hispida*		Unknown	Whiting 1939:88.
93. *Phacelia integrifolia*	Phacelia		
94. *Cryptantha crassisepala*		Used as a medicine (for boils and to relieve extreme fatigue).	Whiting 1939:88, and Stevenson 1915:45.
95. *Cryptantha jamesii*			

TABLE 3.1. (continued).

Scientific Name	Common Name	Possible/ Probable Use	Reference
96. Poliomintha incana		Used as a food source (greens and flowers are used for flavoring).	Whiting 1939:91.
97. Datura meteloides	Sacred Datura, Jimson Weed, Thornapple	Used as a medicine or narcotic, and for ceremonial usage.	Yarnell 1959: 176-178; Whiting 1939:89; Safford 1920:550-554; and Stevenson 1915:39, 41, 46-48, and 88-91.
98. Lycium pallidum	Tomatilla, Pale Lycium	Used as a food source (berries) and for ceremonial usage.	Whiting 1939:89, and Stevenson 1915:68 and 94.
99. Nicotiana attenuata 100. Nicotiana trigonophylla	Wild Tobacco, Indian Tobacco	Used primarily for smoking, but sometimes mixed with other plants for ceremonial and medicinal purposes.	Sweet 1976:48; Castetter and Bell 1942:108-113; Whiting 1939:90; and Stevenson 1915: 95.
101. Physalis fendleri	Ground Cherry	Used as a food source (fruit).	Whiting 1939:90, and Stevenson 1915:70.
102. Solanum elaeagnifolium	Trompillo, Bull Nettle	Used for a medicine (roots for toothache) and as a food source (berries).	Whiting 1939:30, and Stevenson 1915:60 and 70.
103. Castilleja integra	Indian Paint Brush	Used as a source of dye (roots).	Stevenson 1915: 80.
104. Castilleja linariaefolia	Painted Cup	Used as a medicine and as a dye source.	Whiting 1939:91.
105. Mimulus guttatus	Common Monkey Flower	Used as a food source (greens) and as a medicine (roots).	Sweet 1976:51.

TABLE 3.1. (continued).

Scientific Name	Common Name	Possible/ Probable Use	Reference
106. Penstemon ambiguus		Used as a medicine (flowers).	Sweet 1976:53, and Whiting 1939:91.
107. Verbascum thapsus	Common Mullein	Used as a medicine (leaves smoked like tobacco).	Whiting 1939:92.
108. Cucurbita foetidissima	Wild Gourd, Buffalo Gourd	Possibly used as utensils (although Whiting feels "the rind is unsuitable for the use as utensiles") in prehistoric time.	Minnis 1984:4; Gasser 1982a:24-25; Castetter and Bell 1942: 107-108; Whiting 1939:93; and Stevenson 1915: 45-46 and 66-67.
109. Artemisia filifolia	Sand Sagebrush	Used as a medicine	Whiting 1939:91, and Stevenson 1915:42 and 87.
110. Artemisia frigida	Mountain Sagebrush Wormwood	Used as a food source (leaves), for ceremonies, and for medicine.	
111. Chrysothamnus nauseosus	Rabbit Brush	Used in the making of baskets, and as a fuel source (kiva fuel).	Whiting 1939:95, and Stevenson 1915:81.
112. Chrysothamnus viscidiflorus			
113. Cirsium pulchellum	Thistle	Used as a medicine.	Whiting 1939: 95-96.
114. Franseria acanthicarpa	Bur Sage	Food for sheep.	Whiting 1939:96.
115. Gaillardia pinnatifida	Blanket Flower	Used for medicine.	Whiting 1939:96.
116. Gutierrezia microcephala	Snakeweed	Used for medicine.	Whiting 1939:96, and Stevenson 1915:53.
117. Gutierrezia sarothrae			
118. Helianthus petiolaris	Sunflower	Used as a food source (seeds) and for dye.	Harrington 1972: 127-130 and Whiting 1939:97.

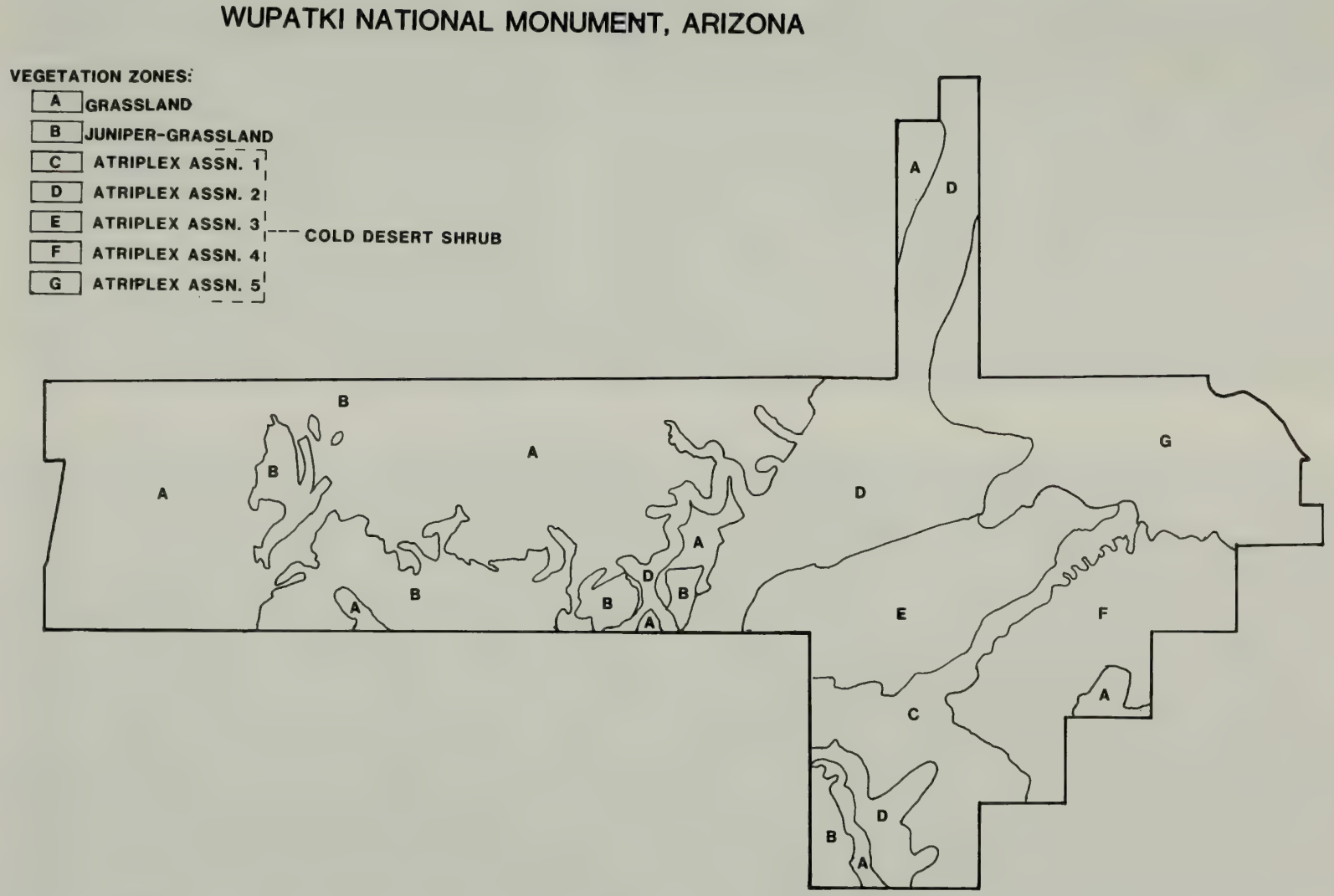
TABLE 3.1. (concluded).

Scientific Name	Common Name	Possible/ Probable Use	Reference
119. Senecio longilobus 120. Senecio multicapitatus	Groundsel	Used as a medicine (for sore muscles and as an eye wash).	Whiting 1939:98, and Stevenson 1915:59.
121. Tetradymia canescens	Unknown	Used as a medicine.	Whiting 1939:98.
122. Zinnia grandiflora	Zinnia	Used as a medicine (eye wash and for fever).	Stevenson 1915: 45.

louisiana (devil's claw) and Agave spp., apparently were not utilized in this case as a food source (Reed and Brewer 1937:19; Stanislawski 1963:409-410). Devil's claw is often utilized as a food source (seeds) (Stanislawski 1963:469; Yarnell 1977:869-870; Reed and Brewer 1937:18-19), as is agave (Minnis 1984:6-7; Gasser 1982a:24; Harrington 1972:58-61; Stanislawski 1963:469), but it is unknown if Wupatki inhabitants ever used them as food. Two other plants were also important, indicated by their presence at several archeological sites recorded during the survey process. One of these plants was wild tobacco, which was generally smoked in tubular pipes or in hollow reeds (Douglas 1931). The other plant was Datura meteloides, which may have been utilized for its narcotic qualities (Yarnell 1965:667-668, 671-672).

With the introduction of several varieties of corn, beans, and squash, the mode of life of prehistoric southwestern pueblo people was altered to a more sedentary agricultural subsistence (Bartlett 1931:4). However, "famous culinary triad" accounts for only about half of the diet (Minnis 1984:3). Corn agriculture was certainly a gift of the gods, and so were the accompanying weeds, which were also tended and harvested (Ford 1984:130). Corn (Zea mays), even if it was not a high-yielding crop, could be predictable in its location and caloric contribution (Ford 1984:130). Certainly, the importance of Zea mays to Wupatki is indicated by the corncobs, stems, and leaves located at Wupatki Pueblo (Stanislawski 1963:468); the charred corncobs and kernels found at NA680 (Smith 1952:35); cobs, husks, roots, and kernels found at NA681, Three Courts Pueblo (Smith 1952:24-25); and a number of fully kerneled cobs found at Juniper Terrace, a site just south of Wupatki National Monument (Smith 1952:79). Also, numerous kernels and cobs (mostly charred) were found at Nalakihu, but most of these are small and appear to be nubbins or abnormalities (Jones 1949:152-157). Corncobs were located during the excavation of Crack-in-Rock Pueblo (Smith 1952:76), a few have been found at several unexcavated sites during the survey project, and some have even been discovered in

FIGURE 3.9. Wupatki Vegetation Zones.



earth cracks (Morris 1976:45-49). "Corn is one of perhaps not more than a dozen species of cultivated plants of world-wide importance--each one the principal source of food of millions of people--which quite literally stand between mankind and starvation" (Mangelsdorf 1958:1313). Corn was the most common element of the archeobotanical remains from the Coronado Project, in Apache County, northeastern Arizona (Gasser 1982b:24). Judging from the number of prehistoric field systems located during the Wupatki survey, I am sure Zea mays was one of the most important domesticated plants grown, and it probably was the mainstay of survival.

Next in order of importance may have been squash and pumpkins. Cucurbita moschata, Cucurbita pepo, and Cucurbita mixta were found at Wupatki Ruin (Stanislawski 1963:467). C. moschata seeds were recovered at Nalakihu (Jones 1949:152-157), and an unidentified squash fragment was located at Crack-in-Rock Pueblo (Smith 1952:76). "Oldest archeological cucurbits are C. pepo and Lagenaria siceraria, the bottle gourd" (Cutler and Whitaker 1961:469). Bottle gourd remains were found in Rooms 7 and 11 at Wupatki Pueblo (Stanislawski 1963:467). C. pepo was the first cultivated cucurbit, and C. moschata was the next cultivated species to enter the Southwest (Cutler and Whitaker 1961:478-479). Some charred seeds and stems of C. pepo were also identified from the Winona Village excavations (Jones 1941:296-297).

Third in the triad, but less prevalent in the archeological record, are beans. Because beans are generally prepared by boiling, they are sometimes found charred and preserved (Gasser 1982b:20). Six varieties of the common bean were grown in Tsegi Canyon during Pueblo III times; and five additional varieties of common beans, one lima, and tree tepary varieties were grown in Verde Valley at the same time (Kaplan 1965:153). Because of these occurences to the north (Tsegi Canyon) and to the south (Verde Valley) of Wupatki National Monument, it is quite probable that beans were an important domesticated plant,which could have been cultivated at Wupatki. Lima beans, Phaseolus lunatus, were found at Wupakti Pueblo in four different rooms (Stanislawski 1963:466), and beans were found at NA680, in the Big Hawk Valley (Smith 1952:35). Two uncharred beans and a pod were found at NA 863 (Medicine Cave), and charred kidney beans of the same species (Phaseolus vulgaris) were excavated from NA 862 (Medicine Fort) (Bartlett 1934:66-67). These two sites are near the southwest boundary of Wupatki National Monument, south of Juniper Terrace. Several bushels of burned corn and beans were recovered from Winona Village (McGregor 1941:261) and identified as kidney beans, P. vulgaris, and teparies, P. acutifolius (Jones 1941:267-268). This may be the first noted occurrence of tepary beans.

Another domesticated plant is worth discussing because of its use in the manufacture of fabric. "Prehistoric cotton was grown and made into cloth fabrics in every part of the state of Arizona" (McGregor 1931:1). Cotton usage was very important to the people living at Wupatki Pueblo, as there were hulls, stems, seeds, and leaves found during the excavations (Stanislawski 1963:468). There is some difference of opinion as to whether cotton was grown prehistorically in northeastern Arizona or was obtained through trade from the south. With the excavation of a wad of cotton waste, bunches of fiber, and cotton balls still containing seeds, it was felt that these were not trade items (Kidder and Guernsey 1919:113). At Antelope House, in Canyon

del Muerto, 1,100 specimens of cotton textile and 1.9 kg of raw cotton (fiber, seeds, balls, a few stem fragments, and one leaf) were recovered, more than from any single site in the Southwest (Magers 1975:39). "Cotton in the Flagstaff area is thought to have been traded in, since growing the plant in that high cool region might not be feasible" (Kent 1957:469). All of the aboriginal cotton found in the Southwest is Gossypium hopi (Jones 1936:57). This type has the shortest growing season (84-100 days) and can be succesfully grown at high altitude and under arid conditions. "This cotton is remarkable for its earliness; plants have ripened bolls in 84 days from the sowing of the seed" (Lewton 1912:6). Thus, if cotton was grown in Tsegi Canyon, Canyon del Muerto, and the Hopi Mesas, it probably could have also been cultivated at Wupatki. The amount and quality of woven cotton materials excavated from Wupatki Ruin should also indicate the importance of the plants (Stanislawski 1963:468-469). Numerous items are listed, which show a great diversity of weaving methodology (Kent 1957:660-724). This abundance of fabrics should also be a strong indication that cotton was produced locally (Jones 1936:60). Finally, spindle whorls, a batten fragment, and a temple or tenter stick were also found at Wupatki Ruin (Kent 1957:473). These weaving implements offer additional indirect evidence that prehistoric cultivation of cotton existed (Jones 1936:54). All in all, I feel that cotton was probably cultivated at Wupatki locally, and cotton materials may have also been utilized for outside trade in the greater Flagstaff area.

To conclude the discussion on domesticated plants, I would like to include a few comments on experimental gardens. Three experimental gardens have been attempted in the Wupatki-Flagstaff area (Colton 1965; Maule 1963; Gasser 1979), and all three reports emphasized the damaging effects that rodents had on the crops. It is possible that this single factor can help to explain the many field structures ("fieldhouses") found at Wupatki. This factor may have been so demanding prehistorically that constant supervision of the fields may have been required to ensure any crop success.

Steve Cinnamon, the resource management specialist at Wuptaki, conducted a study of pack rat midden deposits. Materials from this type of deposit can help to explain important differences in prehistoric and modern flora in areas with few other sources of perishable organic materials (Van Devender and Spaulding 1979:701). "A packrat midden yields plant microfossils from within 30 to 50 m. of the sampling locality" (Betancourt and Davis 1984:56). It is suggested that woodcutting by prehistoric populations in Chaco Canyon caused the reduction of marginal stands of pinon and juniper trees, and there was no recovery over the past millennium (Betancourt and Van Devender 1981:658). Because few pinons grow at Wupatki National Monument today, it is suggested that the same situation may have existed at Wupatki; however, the juniper have been increasing historically in some areas (Cinnamon 1988:79). There is now considerable evidence that prehistoric man exploited all of the available resources and did not necessarily live in harmony with his environment (Cinnamon 1988:86). No midden dates were recorded for the period of prehistoric occupation, which could also be an indication of the pressures exerted on the environment, as the wood rat nest materials may have been gathered to supplement meager fuel sources (Cinnamon 1988:72).

To complete this section, a few closing remarks are necessary. "Corn, beans, and squash were definitely consumed by the

Anasazi, but the evidence suggests that many non-domesticates were of equal or greater importance" (Gasser 1982b:49). Not only was corn agriculture extremely important, but so were the accompanying weeds, which were tended and harvested along with the corn (Ford 1984:137). This element allowed the prehistoric population to increase the edible biomass within the area, increase the predictability of yield, and improve nutrition. In a study of prehistoric coprolites from three sites in the Mesa Verde area, it was found that the fecal record showed more late specimens containing corn and beans and fewer containing squash and pinon (probably due to a change of dietary importance of these plants) (Stiger 1979:134). Pinon nuts are a high protein and fat food source, and corn is a high carbohydrate food source. It is suggested that in some areas people evidently turned to corn as a substitute for pinon nuts when they were becoming scarce (Plog 1979:129). The pack-rat midden study supports this argument for the Wupatki area also because there were probably greater stands of pinon prehistorically. Certainly, corn cultivation offers much greater predictability than pinon nut production and allows the population to be more sedentary,this model still allows for some limited usage of pinon nuts obtained through trade or specialized collection trips made nearby--for instance, communal hunts or drives.

Fauna

Several major contributions have been made to the study of the modern fauna of Arizona and Wupatki National Monument. Some of the more important of these are Lowe (1964), Cockrum (1960), Lincoln (1961), and Bateman et al. (1976-1981). All of these studies, dealing with classification, range, and distribution of fauna, expand upon C. Hart Merriam's (1890) initial work in northern Arizona. Also included with these contributions are faunal checklists, which supplement other listings established over the years. Some of these additional lists are Nichols (1939), Hargrave (1933a, 1933b), Phillips (1947), Bradley and Lewis (n.d.), Phillips (1956), Hoffmeister (1966), Carothers (1967), Hoffmeister and Carothers (1969), and Howk (1982). Finally, since the establishment of Wupatki National Monument in 1924, the National Park Service staff and visitors to the area have maintained observation lists of sightings of various birds, mammals, and reptiles. While the major emphasis has been on bird observations over the years, a great deal of information is also available on other faunal forms.

Before the 1960s, faunal remains that were nonhuman or not culturally modified (made into tools or other items) were rarely studied thoroughly for a archeological excavation (Olsen 1971:1). Most reports including faunal materials were generally only lists of the animals present and did not interpret what these remains meant or how they were utilized (Meighan et al. 1958; Olsen 1971:1). Faunal remains saved or recognized as important to archeologists, because (1) there was a tendency in archeology to regard animal remains as being of a much lower rank than tools produced by man (2) the archeologist often felt frustrated that the possibility of gleaning any specific information about culture from bone was very remote; and (3) most zoologists were unfamiliar with archeological procedures and inquiries and could not supply information for any unasked questions (Daly 1969:146-147). With these limiting factors in mind, the excavated faunal material from Wupatki National Monument can be discussed and some recommendations for additional studies provided.

There are only a small number of excavated sites at Wupatki, and there is a definite lack of information available on any other excavated sites within the boundaries. Thus, about 0.3% of the available sites have any information on faunal materials, and this is primarily only checklist information, indicating what animals were present. Wupatki Ruin (NA405) offers the largest sample of faunal remains, with collections presently housed at the Museum of Northern Arizona. It is hoped that these collections can someday be reanalyzed utilizing today's zooarcheological standards.

At Wupatki Pueblo, 94% of the total number of individuals were confined to only six species (jackrabbits, cottontail rabbits, prairie dogs, deer mice, wood rats, and pronghorns), with about two-thirds of these confined to only three species (Lepus californicus, jackrabbits; Sylvilagus auduboni, cottontail rabbits, and Antilocapra americana, pronghorns). Thus, it appeared that jackrabbits were the most common food animals utilized by the prehistoric inhabitants of Wupatki Pueblo (Lincoln 1961:55). The pronghorn antelope was the most preferred large game animal, with 124 individuals (Lincoln 1961:76). At the five sites excavated in Big Hawk Valley (also including Crack-in-Rock Pueblo), 82% of the total bones recovered were confined to only four species (cottontails, 41%; prairie dogs, 19%; pronghorn antelopes, 15%; and jackrabbits, 7%). Most common were the cottontail rabbit and the prairie dog, both of which were good food sources (Smith 1952:181). At WS-1432, about 55% of the remains were of small mammals, and the large mammals were also strongly represented (Zunie 1989:1-14). Other excavated species which deserve comment are black bear (King 1949:141), wood rat (King 1949:141; Smith 1952:181; Lincoln 1961:58-59), numerous birds (King 1949:141; Smith 1952:181; Hargrave 1959); and fish (Lincoln 1961:81). No fish remains were recovered from the Big Hawk Valley or Nalakihu excavations. Table 3.2 gives a rough breakdown of what limited information exists for faunal remains. More discussion of these and other faunal elements will follow within this section, but the emphasis will be shifted toward other aspects (garden hunting, meat procurement, dietary importance, domesticated animals, trade, etc.).

The numerous agricultural fields utilized prehistorically at Wupatki not only provided food for the human inhabitants, but also attracted several other animals and insects already in the vicinity. To protect their crops from damage by these predators, the prehistoric farmers probably had to hunt and trap rodents and birds within those field areas on a regular basis (Emslie 1983:120). As the society became more dependent on an agricultural economy, trapping and hunting within the fields also became more economically necessary because less time was probably available for hunting away from the fields and villages. The field areas helped also to increase the edible animal biomass, even if larger numbers of smaller mammals had to be captured to satisfy the protein needs of the society (Ford 1984:137). This type of hunting behavior, called "garden hunting," helps to explain the selection of certain types of prey (Seme 1984:143). As humans trap, remove, and utilize these crop pests, they also create a situation for the influx of other animals, which provides a constant supply of garden game (Seme 1984:157). Animals that may have had previous limited value as a dietary item (such as small mammals, rabbits, and rodents) might have increased in importance and entered into the diet in major proportions due to this single factor.

This section looks at hunting ritual, hunting activity, and any other means of ac-

TABLE 3.2. Excavated sites which have listed faunal remains.

Sites	Number Of Bones	Number of Individuals	Large Mammals (Game Animals)	Small Mammals	Birds	Potential for further study
Wupatki Pueblo (NA 405)	Unknown	1005	3 species	22 species	8 species	Yes
Citadel Pueblo[a] (NA 355)	4	Unknown	2 species	--	--	N/A
Nalakihu (NA 358)	Unknown	Unknown	4 species	9 species	5 species	?
Three Courts Pueblo (NA 618, WS-437)	16	Unknown	1 specie	3 species	--	?
NA 680, WS-463	88	Unknown	3 species	7 species	2 species	?
NA 681, WS-467	47	Unknown	2 species	5 species	--	?
House of Tragedy (NA 682, WS-472)	38	Unknown	1 specie	4 species	2 species	?
Crack-in-Rock Pueblo (NA 537, WS-831)	16	Unknown	1 specie	3 species	--	?
WS-1432[b]	202	Unknown	3 species ?	4+ species	1 specie	Yes

[a]This is an un-excavated site, but limited bone materials were obtained from an interpretative sign-post excavation.
[b]This site was excavated in 1989 as part of a cooperative program between the National Park Service and Northern Arizona University.

quiring animals for food. Hunting and hunting ritual have not been widely considered in the literature, but other procurement means are frequently discussed. "Most observations on hunting have been done by persons totally inexperienced in either the ways of hunting or the behavior of the species hunted" (Frison 1978:363). Many types of communal hunts on the Plains were carried out with ritual restrictions (Frison 1978:363), and the ritualistic hunting views of the Hopi Indians are widely known (Beaglehole 1936). Most of the other means of procurement (trapping, jumping, driving, and corraling) are known primarily from Plains examples.

Some prehistoric and historic communal hunting methods have included bison drives over jumps, into traps, and into corrals (Frison 1978:229-248). Along with jump sites, where topographic features were utilized, are driving lines, which aid in moving a herd of animals to the desired feature (Frison 1978:230-231). Some southwestern communal hunting sites may have utilized a combination of methods. The frequency and use of communal drives needs to be examined further, with special considerations given to the local conditions affecting the animal populations (Frison 1978:244-248). Antelope could be easily procured by driving the animals into a trap or corral (Frison 1971:267). At a Shoshonean site in Wyoming, it was assumed that a brush corral may have been constructed for this purpose. Similar corrals could have been utilized for the same purposes at Wupatki, which may help to explain the high frequency of pronghorn from the excavated sites. The Hopis often have communal rabbit drives, and they also trap rabbits within nets made for this purpose (Nequatewa 1946:61-62). Organized rabbit hunts were held most frequently during early summer and autumn, when the fields needed to be protected (Beaglehole 1936:11). The Hopi would scrape the skins of the rabbits and cut them into strips to make robes (Beaglehole 1936:14). Hunting initation for the Hopi boys occurred when a young man killed his first jackrabbit (Beaglehole 1936:15). Other types of small game and birds were collected by the Hopis with deadfall traps or snares (Beaglehole 1936:17).

Once meat was obtained, it was prepared for food. The combination of butchering and consumption will produce what is reflected in the archeological record, that is, bones and bone fragments. During the butchering process selections are made as to what parts of the internal organs, head, feet, muscles, bones, sinew, horns, etc. will be saved. The selection made at the kill, the butchering site, and the camp should be reflected in the archeological record (White 1952, 1953a, 1953b, 1955). "Every animal used as food by humans requires some preparation to render it usable. Many things affect the degree and kind of preparation applied to a given animal. Some factors are cultural; some are dictated by the environment; and some are determined by individual preferences" (Frison 1978:301). Often included within the butchering procedure is processing beyond the removal of the meat from the skeleton of the animal. This can include skinning the animal, removal of the entrails, processing the bone for marrow, cooking meat or bones, collecting the blood, or drying the meat. Again, some of these additional processes may be reflected archeologically in the remnants. The most important task during butchering is to open the throat and body cavity and to remove the windpipe to allow the animal to cool so that the meat will not sour (Frison 1978:303). Some butchering procedures (such as allowing flies on the meat or not properly bleeding the animal) would upset most Americans

today but would not be crucial to the edibility of the meat (Frison 1978:302-304). Better collection of faunal materials and better recording of the provenience of bone materials from future excavations at Wupatki National Monument may reveal some of these processes.

Dietary importance of certain species has already been discussed somewhat. However, some additional discussion is necessary to explain some other aspects involving the selection of certain animals. Some of these determining factors are the availability of species, cultural preferences, protein needs, and other dietary requirements. The animals found at Wupatki National Monument today are similar to those which were recorded from the excavations, thus indicating that there has been little change in the past 900 years (Schroeder 1977:12). As indicated in Table 3.2, the greatest diversity of fauna was in the small mammals, and it would be important to compare small-game and large-game ratios to get some rough estimate of meat consumption by the prehistoric population.

There are several problems, however, in comparing large game animals and small game animals. With the larger animals, generally hunted far away from the habitation sites, most of the meat may have been removed at the kill and then transported without the bones. As was mentioned, the smaller animals, acquired through "garden hunting", probably were brought back complete to the pueblo for processing there. "The abundance of artiodactyls relative to lagomorphs has often been used as an indicator of small versus large game within an assemblage" (Szuter, in press). At Medicine Cave, a site just south of Wupatki, a small quantity of split bone was located, which came probably from deer and antelope leg bones. These bones were probably split to obtain the marrow (Bartlett 1934:67). The bones of large mammals broken for stews and marrow are often difficult to identify because morphological bone features are missing or obscured (Szuter, in press; Pierce 1989:27). At Homolovi II, a site east of Wupatki, it was found that the ratio greatly changed when the unidentified large mammal bones and small mammal bones were counted, suggesting large game may have been more common than otherwise indicated (Szuter, in press. Another skewing factor could be one of cultural or ritualistic usage for certain bones. Within Cohonino sites, west of Wupatki, bone tools were found within the sites, but there was a definite lack of other bone materials present. It was suggested that there may have been some taboo against leaving animal bone within the habitation areas (McGregor 1951:115-118, 128-129). At the Hopi mesas, north and east of Wupatki, the skulls and bones of large mammals (pronghorn, deer, and mountain sheep) are often placed on shrines outside of the villages (Beaglehole 1936:7-8, 11). All of these many varied reasons can affect what occurs within, excavated faunal skeletal remains, and some caution should be required before any factual statements are presented. Other destructive agents can affect bone accumulations, including cooking, human chewing of fragile bone, dog gnawing, birds removing small bone pieces, and rodent gnawing (Brain 1976:99-104). A number of the smaller mammal and bird bones could have been absorbed through these mechanisms. Thus, when comparisons between large and small faunal forms are made, possibly to establish some estimate of meat usage for other reasons, the reader should be aware that the real picture may have been altered long before any archeological investigations were ever conducted.

A few additional comments are necessary to discuss both the availability of species and cultural preferences for the faunal materials found at Wupatki National Monument. Within the many rock art examples throughout the Monument, there are many depictions of bighorn sheep, although prehistorically they must have ranged in the more mountainous regions of the San Francisco Peaks (Cockrum 1960:257-258). This probably reflects a cultural preference for a species that was difficult to obtain locally. Another suggestion is that this animal form was utilized only as a decorative motif (Grant 1978:191). There is little doubt that the bighorn sheep was one of the most preferred zoomorph representations in the rock art sites. Another animal represented in the faunal record from the excavated sites is the wood rat, Neotoma. The larger forms of this species, noted by Lincoln (1961), may have been hunted to extinction by the prehistoric inhabitants (Cinnamon 1988:71). There were no woodrat middens dating within the prehistoric occupation period, and it is suggested that the nest materials were gathered for fuel sources (Cinnamon 1988:72). Thus, the woodrat population prehistorically may have been one of the more preferred sources of both food and fuel. Numerous bird remains found in the Wupatki, Big Hawk Valley, and Nalakihu excavations may also reflect some cultural preferences. Table 3.3 lists some of the varieties found. "Hawks, falcons, and ravens may have been used for their feathers and complete wings in costumes and ceremonies, or for trade, as they are today" (Emslie 1981:327). This may have also been the main use of for the Wupatki avifauna. It is interesting to note that there are no waterfowl remains from the Wupatki sites, although the Little Colorado River is only 10-15 miles away. Within the faunal remains of Homolovi II and Homolovi III, several waterfowl were represented (Szuter in press; Pierce 1989:1-30). It has also been suggested that several ponds and lakes formed after eruption of Sunset Crater, which could have attracted numerous water birds (Schroeder 1977:33). It is possible that ducks and geese were not culturally preferred by the Wupatki inhabitants and were not hunted for food or feathers.

Along with the consumption of meat goes the concept of diet and dietary requirements. Some attempts have been made to calculate the amounts of usable meat weights from faunal bone remains in an archeological context (White 1953:396-398; Stewart and Stahl 1977:267-270). More work needs to be done to refine some of these estimates and determine if protein needs were being satisfied in certain agricultural societies. When the bulk of the food produced is through agricultural practices rather than hunting and gathering carbohydrate levels increase, and fat and protein levels would decrease (Yudkin 1969:548). Energy requirements vary with what is needed to maintain body processes, physical activity, the energy of specific dynamic action, and the energy needed to maintain body temperature (Wing and Brown 1979:21). Protein serves as a main source of amino acids for building and repairing tissues and can provide energy when other energy sources (fats and carbohydrates) are limited (Wing and Brown 1979:27). Inadequate or excessive intakes of either specific nutrients or calories can also lead to nutritional diseases, and the success of any group is in selecting the best foods (Wing and Brown 1979:44). In times of food stress, the nutrient values could have been severely altered. Winter meals probably offered the poorest sources of these nutrients because they may have consisted mainly of stored foods: dried maize, beans, wild grains, cactus pears, and dried

TABLE 3.3. Arifauna from excavated sites.

Species	Wupatki Pueblo (NA 405)	Big Hawk Valley (NA 680 and NA 682)	Nalakihu (NA 358)
Red Tailed Hawk, Buteo jamaicensis and borealis	x	x	
Sparrow Hawk, Falco sparverius	x	x	
Scaled Quail, Callipepla squamata	x		
Road Runner, Geococcyx californianus		x	
American Raven, Corvus corax	x	x	x
Great Horned Owl, Bubo virginianus	x		x
Burrowing Owl, Speotyto cunicularia	x		x
Long-eared Owl, Asio otus			x
Short-eared Owl, Asio flammeus			x
	(Hargrave 1959)	(Smith 1952)	(King 1949)

NOTE: I did not include parrots or turkeys as they are discussed elsewhere in Chapter 3.

fruits. Good sources of vitamin C such as fresh fruits and grains would not have been available (Wetterstrom 1986:112). The consumption of some winter animals, low in body fat, can also cause nutritional stress (Speth and Spielmann 1983:3). To fulfill all dietary needs, a number of strategies would have been required. While maize and other harvested wild plants provided the bulk of needed calories, protein still had to be derived mainly from animals (Ford 1984:138). Meat may have also been required for an adequate intake of iron into the diet (Cordell 1980:90). Other dietary consequences that occur where protein sources are limited can indicate a limited source of vitamin B, some calcium deficiency, and an increase in dental caries (Yudkin 1969:549). An excess of protein can also create problems. Consumption of fat (and carbohydrates) may be required to assist in protein metabolism, especially in the spring, when those nutrients may be the least available (Wills 1989:141). Fat can be obtained from both bone marrow and bone grease (bone lard), and the processes required for preparation of this food source has been described at length (Binford 1978:145-146, 157-159; Speth and Spielmann 1983:19). Other mechanisms that may have been utilized prehistorically are meat drying

(Bartlett 1931:4) and food redistribution (Lightfoot 1979:319-339).

Important trade in faunal materials no doubt existed prehistorically at Wupatki, but the exact extent is not well revealed in the archeological record. Historic trade for meat, lard, grease, and hides was described by John Kessell for Pecos Pueblo and various Plains Indian groups (1979:262-263, 364-366, 405-407). It is reasonable to assume that there may have been some prehistoric exchange or trade at Wupatki of meat, especially if it was dried for easy transport, but the evidence may not be preserved within the archeological context (trash middens or room fill).

However, parrots and parrot feathers were certainly a major trade item. A total of 685 parrot bones were recovered from Wupatki Pueblo representing an estimated 41 individuals (Hargrave 1970:38). This is the greatest number of parrots found at any single archeological site in the southwestern United States, even more than at Pueblo Bonito in Chaco Canyon, which had 31 (Hargrave 1970:38). Two types of parrots are found at Wupatki: a red, blue, and yellow macaw (Ara macao) and a thick-billed parrot (Ryhnchopsitta pachyrhyncha) (Hargrave 1933d:26; Stanislawski 1963:61; Olsen 1967:57). A macaw found at Nalakihu was initially identified as a military macaw (Ara militaris), but it was later identified as (Ara sp. (King 1949:141; Hargrave 1970:39). The normal range of macaws does not extend north of southern Sonora, Mexico (Olsen 1967:59) and while the thick-billed parrot can be a sporadic visitor in southeastern Arizona and southwestern New Mexico, its natural habitat is northern Mexico (Olsen 1967:59; McKusick 1974:279).

In order to appreciate the extent of the parrot trade, and what was involved prehistorically in the raising of these birds out of their natural habitat, we need to look to the site of Casas Grandes in northern Mexico. A total of 503 macaws were found at this site, of which most were found in various articulated positions indicating accidental death or purposeful burial (McKusick 1974:272). There is little doubt that the people who lived at this site provided the raw material required by feather merchants by maintaining and controling their own stocks of birds (McKusick 1974:267). It could also be suggested that most of the live macaws that entered the Southwest probably came through this major trading center. There is no good evidence that macaws were successfully bred north of Casas Grandes (Lang and Harris 1984:117), and many of the Southwest samples show pathologies related to accidental injury, poor diet, maltreatment, or lack of sunshine (Judd 1954:264; McKusick 1974:280; Lang and Harris 1984:117). Food materials found at Pueblo Bonito and associated with macaws included pinon nuts, squash seeds, and roasted corn on the cob (Judd 1954:264). Other available macaw food prehistorically could have included acorns, beans, other corn, meat (both cooked and raw), cactus fruit, pumpkin, sunflower seeds, wild tomatoes, and walnuts (McKusick 1974:281). All of the above food materials could also be found at Wupatki (see Table 3.1 in this chapter). Because many of the macaws from Casas Grandes and elsewhere were found buried in kivas, great kivas, platform mounds, and plazas, some ceremonial usage is suggested (McKusick 1974:283; Lang and Harris 1984:115). Some old birds have been located with human burials, and these were apparently personal pets. Generally, the birds were plucked before burial (McKusick 1974:276), and one example from Kiet Siel shows this was also done in the Kayenta Anasazi area (Hargrave 1970:34). It is thought that the transportation of live

macaws, especially over great distances would have been easiest after the juvenile bird was fully feathered and was beyond the danger of respiratory infection, a frequent cause of death to young birds that have been subjected to chilling (McKusick 1974:276).

With the above background in mind, we can now again concentrate on macaws from Wupatki Pueblo. Macaw feathers and other soft parts are rarely found outside of caves because of their perishable nature (Hargrave 1970:1). The evidence of the presence and use of macaws in an archeological context must come from a study of excavated bone elements. No artifacts made from macaw bones have been found, nor is there any indication that parrots were ever used for food. At least 11 articulated and intentional parrot or macaw burials were found at Wupatki Pueblo, as well as many additional bones (Stanislawski 1963:61). Three of these bird burials were wrapped in a rush matting shown by imprints in the surrounding soil (Hargrave 1933d:26, 1970:36). Five parrot burials were found in the fill of Room 43 (identified as a kiva), four from Room 35, and two from Room 63 at Wupatki (Stanislawski 1963:61). Hartman and Wolf feel that the idea of keeping parrots and macaws may have been derived from the Hokokam (1977:17). Other comparative specimens from nearly sites include Elden Pueblo (one) Ridge Ruin (four), and Winona Village (one) (Hargrave 1970:40-41; Peter Pilles, personal communication).

A Hopi association with Wupatki and the numerous parrots is indicated by a Hopi informant who said that the site was a traditional stopping place of the Parrot Clan of the Zuni on the way from Zuni, New Mexico, to the Grand Canyon (Colton 1934:4). There is also a Hopi legend that Wupatki Ruin was the last home of the Parrot Clan (Stanislawski 1963:61-62). Jim Kewanwytewa, an employee of the Museum of Northern Arizona, related a story about a burial found during the excavation of Wupatki. He was asked by a Hopi man if a man's body was ever discovered at Wupatki with his pets (dogs and parrots), and Jim remembered one burial he had excavated with a dog on the left side and two parrots at the feet. When he asked the man if there was more to be said about the burial, the man related that the rest was in the religion (Kewanwytewa 1957:87). More Hopi informant information is required to better define what relationships the Hopi people have today with Wupatki Pueblo and other sites on Wupatki National Monument.

Some limited faunal domestication did occur in the prehistoric southwestern United States. Dogs and turkeys were the only domesticated animals known among the Pueblo peoples (Colton 1960:107). Evidently dogs were more common than turkeys in the Sinagua and Cohonina cultures (Colton 1946a:314; Colton 1960:71). A disarticulated dog skeleton was recovered from Pit 8 at Nalakihu (King 1949:57). Many excavations of southwestern Pueblos dating between A.D. 1050 and A.D. 1285 have produced domesticated dog remains, revealing that these dogs were morphologically much the same as present-day dogs (Olsen 1985:40).

To understand a little more about these prehistoric dogs (Canis familiaris), some additional commentary is required on the types found, where they occur, and their possible uses. Dogs were probably kept as part-time hunting assistants, garbage scavengers, watchkeepers, and companions (Lang and Harris 1984:90). From the many broken dog bones found at Tse-Ta'a (a site in Canyon de Chelly), it was inferred that dogs were also eaten (Hagg 1966:135). The definition of three types of southwestern Indian dogs (small, short-faced, and large) is

based on osteological measurements (Emslie 1978:175). Before A.D. 800, few large dogs occurred in the Southwest, but they were much more common later (Colton 1970:158). In the Mancos Canyon area of southwestern Colorado, studies also suggest that the size of the dogs also increased slightly through time (Emslie 1978:176). Mummified dogs have also been reported in several areas: near Kayenta (Guernsey and Kidder 1921), Wupatki (Colton 1938), and in Canyon del Muerto (Olsen 1985). Within Anasazi sites, dogs are often found buried on the floor or in the fill of kivas and pithouses (Emslie 1978:180). If more of these structures are excavated at Wupatki National Monument, it is quite probable that more dog skeletons will also be located.

The emphasis that was placed on the usage of turkeys by the prehistoric inhabitants of Wupatki is somewhat questionable, due to the scanty archeological information available. The Pueblo II sites in the Flagstaff area did not provide any evidence of domesticated turkeys (Bartlett 1934:68). It is further suggested that turkeys probably were never domesticated in the Flagstaff district (Reed 1951:197). One of the earliest turkey skeletons found in the area was excavated at Cinder Park. It was apparently killed for the feathers, not for food (de Laguna 1942:56; Reed 1951:198). In areas within the natural range of wild turkeys, such as Flagstaff, they may have been more easily hunted than "domesticated" or kept (Reed 1951:201). More work is needed to determine the osteological difference between "domesticated" and "wild" turkeys (Neusius 1986:263). At least six variations of wild turkey (Meleagris gallopavo) are recognized, based on coloration of the plumage (Olsen 1968:108): "Possibly a statistical study involving numerous measurements of the bones of many individuals would produce a table that could be used to isolate wild and domestic forms on the proportions of the postcranial skeleton alone. It has also been suggested that because it became impossible to drive off the wild turkeys, they had to be corralled to protect the crops and food stores (Pinkley 1965:70-72). There is considerable evidence for the raising and breeding of turkeys at Arroyo Hondo Pueblo, a site near Santa Fe, New Mexico (Lang and Harris 1984:101). There are also many conflicting statements on whether or not turkeys were utilized as a food source, or if they were kept primarily for their feathers (Lange 1950:204-209). Probably turkeys were not utilized for food at Wupatki and other pueblos of the San Francisco Mountains area (Hargrave 1965:161). One scapula with ligaments still attached was excavated at Wupatki Ruin, but it was thought to be modern refuse (Hargrave 1959). Butchering marks were noted on three turkey specimens from Antelope House in Canyon del Muerto (McKusick 1986:148). Butchering marks and with broken turkey bones are good indicators that turkeys were part of the diet at Picuris, Sapawe, Yungue, and Pottery Mound in northern New Mexico (Emslie 1981:325). Several strands of turkey feather cordage were recovered at Wupatki Ruin (Stanislawski 1963:442-444). Sapawe Pueblo (a P IV-V site in New Mexico) may have been a "turkey farm" where feather robes or blankets were manufactured for trade with other pueblos (Emslie 1983:122). Turkey feathers were wound on to vegetal cordage and then twined into robes, which were lightweight yet warm (McKusick 1986:151). The vegetal cordage utilized was generally a wild hemp, which then formed a very compact fabric with the addition of the feathers (Olsen 1968:107). Turkeys may have been used for pest control, that is, in keeping grasshoppers and other insects from the crops (Stiger 1979:140). Finally,

FIGURE 3.10. Looking toward the Little Colorado River (east) from just south of the Visitor Center.

turkey bones may have been utilized in the manufacture of tools and jewelry (Hargrave 1965:161). Two turkey bone whistles were excavated at Wupatki (Stanislawski 1963:289). There is some indication that the making of artifacts from turkey bone followed the use of turkeys for food. Sites where turkeys were used as a food item as a food item often had awls, whistles, and other small bone artifacts made from other mammal bone prior to changing to turkey bones (McKusick 1986:151). Any turkey remains are so rare in the excavated sites at Wupatki that it is almost impossible to make any definitive statements about the usage or place of the birds in the environment.

Conclusion

In this chapter, some explanation of environmental cause and effect has been presented. Suggestions for additional study has also been an emphasis. Sources of paleoenvironmental data that are generally utilized include geomorphological, palynological, dendroclimatological, macrobotanical, and faunal studies (Cordell 1984:35). Additional research is required in all of these areas for Wupatki National Monument. Excavated materials need to be reexamined with these factors in mind, and additional archeological excavations need to be conducted to obtain this sort of information. For the prehistoric inhabitants to survive, they had to obtain adequate food (Jochim 1981:64-75). To do this required time efficiency with a limited production time; labor efficiency, with an emphasis on maximizing production with the least effort; and land efficiency, with an emphasis on the most effective use of the land. Clues to how successful they were should be reflected in the record, if we as archeologists can only recognize those subtle clues.

Chapter 4

THE PREHISTORIC AGRICULTURAL LANDSCAPE OF WUPATKI NATIONAL MONUMENT

Scott E. Travis

Introduction, Objectives, and Organizing Principles

Throughout the recent history of American archeology, the study of prehistoric agriculture has encompassed a range of research interests and perspectives, including the desire to trace the origin, development, and dispersal of agriculture in the Americas; the recognized significance of domesticated cultigens to subsistence economies maintaining sedentary forms of settlement; and the shear diversity of resources available for investigating agricultural technologies and strategies. In the northern Southwest, agriculture has been particularly important to reconstructions focusing on village emergence, coalescence, and geographical radiation. Identified as the Upper Sonoran Agricultural Complex by Richard Ford (1981), the familiar domesticates of corn, beans, and squash helped support a variety of settlement formats inhabiting diverse local environments. Through the use of innovative farming technologies, these experiments, in conjunction with a plethora of organizational strategies, provided the economic foundation for developing Formative-level societies. When viewed within this context, the agricultural systems preserved at Wupatki National Monument illustrate one solution to the imperatives of subsistence in an arid region.

During the course of the archeological survey literally thousands of field features and small, single - to multiroom fieldhouses related to farming were discovered. Utilized in fields of varying form and function,

these elements comprise an intact prehistoric agricultural system, or landscape, providing an ideal opportunity to examine relationships between technology, land use, and ecology. Equally important, this system played a fundamental role within a much larger regional system extending over hundreds of square miles and numerous climatic/biotic provinces. In short, the arid landscape of Wupatki documents the existence of an ingenious subsistence and settlement strategy in an area often considered inhospitable at best.

The reconstruction of farming landscapes entails identifying all discrete elements of the agricultural system, recognizing their spatial and temporal patterning, and interpreting these within technological, organizational, and ecosystemic frameworks (Melnick 1984; Gregor 1970). In the Flagstaff region, an assortment of sources pertaining to prehistoric farming help in this process. These consist of (1) previous accounts of agricultural fields compiled from surface reconnaissance and limited excavation (King 1949; Berlin et al. 1977); (2) excavation and distributional data from fieldhouse studies within Wupatki and the surrounding area (Bradley 1959; Pilles 1978); (3) ethnographic descriptions of Hopi agricultural practices (Forde 1931; Hack 1942; Bradfield 1971); (4) ethnobotanical reconstructions using a variety of sampling procedures (Weber 1981; Cinnamon 1988); (5) results from three experimental gardens (Gasser n.d.; Maule 1963; Colton 1965); (6) comments concerning prehistoric agricultural tools (Forde 1949); and (7) remote sensing data on field location and characteristics (Berlin et al. 1977; Marozas 1984). While the greatest utility of these sources lies in descriptive and functional clarification of field elements and systems, they also encourage a comparative perspective essential to overall, rather than site-specific, reconstructions.

Despite the abundant information available from both surface and ancillary data, however, a number of constraints tend to limit the reconstruction of agricultural systems. Foremost are problems in locating and identifying farming elements during field survey, judging their possible functions, and developing comparative typologies. Subject to questions regarding the validity of surface data (e.g., Plog et al. 1978; Hodder and Orton 1976; Taylor 1971; King 1978), elements of agricultural systems frequently exhibit indistinct physical characteristics that often remain enigmatic even after identification. Further, assuming that most modifications resulting from farming can be recovered by surface survey--an uncertain proposition considering differential preservation and recording inconsistencies--there then exists the dilemma of discerning function on the basis of surface data alone (Hodder and Orton 1976:18-19). In practice, prehistoric agricultural fields generally appear as clusters of elements (e.g., a set of parallel rock alignments clearly different from the surrounding surface) with shelters or fieldhouses located nearby. Given time, field location and function can be determined with some regularity. However, it should also be kept in mind that any attempt to construct empirically based typologies (see, for example, Woodbury 1961; Rohn 1963; Hayes 1964; Vivian 1974; and Glassow 1980) will encounter difficulties with such impressionistic data.

Another difficulty occurs when attempting to determine the contemporaneity of farming elements from limited artifact assemblages and associated evidence. Rarely do field areas, not to mention separate farming features, exhibit surface artifacts amenable to dating. When relatively sensitive chronological indicators do

appear within the boundaries of fields (e.g., sherd scatters), they generally reflect an admixture of trash having disparate dates and proveniences. Fortunately, this situation may be minimized by examining datable fieldhouses in close proximity to fields. Problematically, though, fieldhouse artifact assemblages exhibit constraints such as low ceramic frequencies, lack of temporally diagnostic artifacts, and multiple occupation or use episodes, all of which undermine chronological reliability. These restrictions inhibit efforts to date specific fields as well as larger areas of the agricultural landscape, and inevitably encourage assumptions that link field systems and adjacent structures on the basis of admittedly limited evidence. While it seems logical to view fields and fieldhouses that are close to one another as being functionally connected, both contemporaneity and spatial/functional relationships may be legitimately questioned (Hodder and Orton 1976:18). terhaps the only reasonable alternative is to rely upon estimates derived from the overall settlement chronology, necessitating broad rather than tightly defined time periods for significant portions of the farming landscape (Woodbury 1961:37; Cordell 1984:190).

A final issue involves comparing the geographical extent and patterning of farming elements in relation to significant contextual variables. This context includes the entire range of environmental characteristics as well as the prehistoric settlement system. If cautiously examined, meaningful relationships may appear between the spatial distribution of farming elements, differences in technology, environmental diversity, and settlement (Woosley 1980:333). Although conceptually clear, comparisons of this sort require sensitive discrimination in the selection of variables and their subsequent operationalization (Jochim 1979:100). Many times, discussions of archeological context ignore complex manifestations in favor of overly simplistic, broad-scale generalizations. Though far from insignificant, cover statements portraying the environment as a backdrop for components of a cultural landscape tend to view ecological systems at relatively large, and at times inappropriate, levels of analysis. This compromises the selection, operationalization, and measurement of variables (Jochim 1979:102; Ellen 1982:76; Butzer 1982:4). Alternatively, by "breaking down the system" into subsystemic components, allowance is made for both complexity and variables with definable parameters of measurement. Reintegration of the system can then proceed by examining the variables and all of their attendant assumptions at various levels of analysis from smallest to largest (Jochim 1979:101).

In a similar way, viewing individual fields and farming elements as representative of an entire agricultural system, a situation all too frequent in the literature covering prehistoric agriculture, minimizes complexity and variability. This problem of the typical farming site or field ignores patterns of variation indicative of choice in agricultural systems as well as "the interface between social organization and ecological relations" (Ellen 1982:xiii). What results is a simplified version of prehistoric farming, or for that matter any type of activity wherein the details of field location, technology, and management for portions of a landscape become obscured by normative descriptions and interpretations. In contrast, by measuring variations in the distribution and configuration of farming elements across diverse ecological/settlement landscapes a better picture may emerge of systemic diversity and organization (Woosley 1980). Even though measurements of this sort rarely if ever explain all aspects of

a system, they do imply correlations that collectively illuminate patterns in the landscape (Jochim 1979).

The ambiguities noted above clearly compromise efforts to reconstruct prehistoric agricultural landscapes. Just as clearly, they indicate the need for a systematic method incorporating field data into consistent procedures of description, pattern analysis, and interpretation. With this in mind, the following objectives outline an approach that emphasizes the impressive interpretive potential of Wupatki's prehistoric agricultural systems.

The initial objective of this discussion will be to characterize the elements, technologies, and functionally variable small sites providing evidence for farming. Basically, this supplies substantive definitions and descriptions of what constitutes the agricultural system archeologically. The next objective evaluates the pattern of land use in relation to the aforementioned contextual variables, and in so doing establishes measurable criteria for estimating the relative importance of environmental and organizational variables in agricultural decision making. A third objective requires examining the distribution of farming elements through space and time, thus depicting the agricultural landscape as an evolving mosaic of land-use patterns. When combined, these efforts empirically reconstruct the physical character of the farming landscape and begin the process of analyzing patterned variables.

With the landscape visually reconstructed, the focus shifts from data description and analysis to interpretation. Therefore, the final objective seeks to outline an interpretive model that discusses various levels of analysis as they relate to issues of agricultural technology, decision-making, land use, geographic variability, and human organization. Clearly, this discussion must be viewed as tentative in nature. A more comprehensive statement examining Wupatki's agricultural systems in comparison to other evidence for prehistoric agriculture in the northern Southwest, long-standing interpretations of regional subsistence, and ethnographic studies of Hopi agricultural practices is in preparation. In effect, this investigation will expand the present discussion by placing Wupatki within a regional context and critically evaluating historical and analogous models.

These four objectives delineate a blueprint for studying prehistoric agriculture wherein archeological data are structured into increasingly complex and comprehensive domains. Accordingly, two organizing principles or orientations have been selected that will assist in ordering the data and interpretations. Encompassing theoretical, methodological, and conceptual concerns, these include (1) the principles of human systems ecology in conjunction with the idea of landscape as an archeological corollary and (2) the use of hierarchical levels of analysis--in this case, micro, meso, and macro--that combine environmental context, data, methods of pattern analysis, questions, and theory in a logical fashion. Although these principles can only be employed sparingly within the scope of this chapter, they do represent an initial attempt to integrate empirical data with appropriate methods and theory.

The guiding principles of human systems ecology provide the theoretical and thematic framework for this study. Critical discussions by many recent scholars, including Clarke (1968), Hardesty (1977), Gibbon (1984), Jochim (1981), Ellen (1982), and Butzer (1982), have clarified the scope and applicability of human ecology. Although recent interest in human ecology has been considerable, its origins lie in early twentieth-century geographical studies. Initially

seen as very similar to general ecology by sociologists and cultural geographers, the premise of a unified ecosystem eventually became attractive to anthropological, archeological, and historical inquiries as more of a heuristic device than an explanatory mechanism. Distinctly different from anthropogeography, environmental possibilism, and cultural ecology, human ecology presented a viable alternative to deterministic explanations of culture and environment, regardless of which was deemed causally preeminent (Ellen 1982).

Briefly, human ecology contrasts with other environmental orientations in its reluctance to assign greater or lesser importance to culture or environment. Where many interpretations view culture in static terms, as either adapting to changing environments by homeostasis-seeking mechanisms or being slavishly determined by the "forces of nature", human ecology perceives the interface between culture and environment as dynamic and experimental. Experimentation may occur at any level from the individual to large-scale groups and incorporate numerous facets (e.g., technology, organizational structures, ideological concepts) of sociocultural behavior. Further, the rate of experimentation can be quite slow, as in presumably stable small-scale populations with simple organizations, or incredibly rapid as evidenced in complex industrial states. Anything but homeostatic, the relative success or failure of human experimentation depends less upon deterministic formulas of environmental or superorganic regulation, and more on mutually interactive connections operating at micro-to macrosystemic levels (Clarke 1968). In a sense, then, human populations neither adapt to, nor are determined by, environmental conditions. Instead, they are as much an integrated feature of ecological systems as any other feature, organic or inorganic (Ellen 1982; Butzer 1982).

The physical manifestation of human ecology, in a very real sense the result of human experimentation and consciousness, is landscape. But as John Stilgoe has perceptively noted, "Landscape is a slippery word" (1982:3). Definitions range from the quite narrow, such as a planned garden, to broad, amorphous concepts incorporating entire continents. For the purposes of this discussion, landscape refers to the elements of human artifact, organization, and meaning as they interact with all levels of the local to regional ecology. In the prehistoric Southwest, this landscape was by and large segemented or isolated, with settlements and land-use areas being separated by varying distances. While most investigators would agree with this characterization, there has been a tendency to overstate the nature of dispersed settlement by inferring that physical isolation also resulted in organizational autonomy. Often, this premise has been developed to such an extent that each and every settlement, regardless of size and/or functional complexity, existed in a social vacuum. More recent interpretations, however, have challenged these assumptions by subjecting the village autonomy model to a rigorous theoretical and empirical critique (Plog 1980; Lightfoot 1984; Upham et al. 1989). This issue may be further examined by employing the concept of landscape as a virtual artifact of settlement strategy, organization, and ecology.

Use of the landscape concept requires structuring spatial relationships through a hierarchical organization that includes micro, meso (semimicro), and macro levels of analysis. As defined by David Clarke (1977:11-15), these levels correspond to structures, between structures, and between groups of structures, but the organizational levels can be constructed to accomodate

larger sets of relationships. Applying this organization to Wupatki results in a convenient mechanism for ordering the "matrix of spatial relationships" (Clarke 1977:15) exhibited in the farming landscape.

In practical terms, then, the combination of a multitiered landscape concept with the theoretical premises of human ecology results in a view of prehistoric land use that emphasizes systemic variability rather than normative constructs of agriculture. If variation in agricultural land use can be demonstrated, then we may be able to determine not only the rationale for subsistence decision-making, but also any changes occurring through time. This variability and its attendant explanation represent the basis for understanding the agricultural ecology and subsistence behavior of the prehistoric inhabitants of Wupatki.

Data Collection and Compilation

The collection of field data followed a three-part format of initial discovery, documentation, and compilation. During the course of successive survey transects, those features identified as agricultural elements were flagged for relocation and noted on the field maps. After completing a designated portion of the survey area, the flagged elements were reexamined along with the surrounding surface and evaluated according to specific criteria. While most elements were more or less recognizable on the basis of construction characteristics alone, many appeared quite similar to their immediate context. Taking a conservative approach, only those elements that revealed distinct, patterned surface remains were documented. Further, reexamination frequently discerned structured fields from what had originally been identified as a scattering of elements, thus enhancing our ability to discriminate both individual elements and fields as the survey progressed.

Documenting the thousands of agricultural elements proved to be a formidable task. Early in the survey, individual elements were recorded as sites themselves. Once I realized that the number and configuration of elements dictated against this method, however, a more expedient approach that documented the type of agricultural element and its location (compass bearing and paced distances) from a recorded site was developed. While this method compromised some aspects of data recovery, it did allow for large numbers of features to be quickly and accurately inventoried. In some cases agricultural elements were close enough to a recorded site that they were incorporated into that site's documentation, presenting another view of agricultural elements within a relatively small portion of the landscape.

A final, more intensive documentation included the systematic, nonrandom selection of 41 distinct fields for detailed mapping and attribute analysis. Radial mapping of each field was carried out using a Brunton compass and tapes. Major contours were drawn in where necessary. These maps provided an essential visual inventory of fields, which could then be examined on an attribute-by-attribute basis. This examination involved morphological and ecological descriptions, overall configuration and size, elements within the field, and a variety of spatial relationships. From this a typology emerged, to be discussed in detail later on, that discriminated seven field types ranging from simplest to most complex. Although this sample should not be viewed as statistically valid, it appears to represent a reasonable approximation of the variety of fields present at Wupatki.

Numerous approaches were also used in compiling the collected field information into usable data sets. Seeking resolution at overlapping levels, these included (1)

tabulating the frequency of agricultural elements per quarter section, (2) depicting both the location and approximate size of field areas in relation to the entire cultural landscape, and (3) calculating the frequency of elements in comparison to operationalized contextual variables.

The initial compilation of data revolved around depicting the frequencies of agricultural elements within a standard unit of space. Short of point locating each feature, the tabulation proceeded by counting the number of individual features--rock piles, pads, alignments, etc.--in association with documented sites in quarter section units. The resulting frequencies were then mapped by quarter section, producing a distributional profile of where and at what density agricultural modifications occurred. Further clarification of location and relative size was achieved by schematically plotting field areas on large-scale maps reconstructing the prehistoric cultural landscape. In this case, small (10-50 elements), medium (51-200 elements), and large (greater than 200 elements) fields could then be examined in relation to one another as well as the overall cultural landscape. More analytical in nature, the tabulation of agricultural elements in relation to contextual variables progressed by developing a set of comparably scaled maps that were overlain for tabulation purposes, resulting in a series of raw counts, percentages, and in some instances acreage densities per environmental variable. These data are presented in the sections concerned with contextual analyses.

Environmental Context

Following the organizational principles outlined in the introduction, and notwithstanding the lengthy discussions of Chapter 3, the environment can be viewed as a hierarchical landscape composed of macro, meso, and micro levels. Going from montane highlands to extensively dissected river basins, the macrolandscape roughly coincides with what has been called the Flagstaff archeological region (Plog 1979:124). This region incorporates the southwest portion of the Colorado Plateau, the San Francisco Mountains, and a transitional belt of limestone upland plains, which act as a physiographic and ecotonal boundary zone. Characterized by strikingly different climatic, geological, and vegetative features, the macrolandscape exhibits a complex, arid mosaic of ecological potential tempered by risk.

Arbitrarily defined, the mesolandscape consists of the area contained within the boundaries of Wupatki National Monument. Fortunately, though, the 56 square miles of Wupatki also represent a microcosm of the regional landscape, and the upland/lowland duality is decidedly pronounced. Running through the Monument from southwest to northeast, the Doney Cliffs provide a distinct barrier between the grasslands and pinon-juniper woodlands to the west, and the lowland cold desert biomes of the Little Colorado River drainage on the east. What distinguishes Wupatki and its immediate environs from the rest of the region, however, is the cinder and ash deposits of Sunset Crater, erupting from A.D. 1064 to 1067 (Breternitz 1967). Altering the boundary between uplands and lowlands, the eruption created a corridor, in effect a distinct habitat, across major regional ecotones. In modifying drainage patterns, soil characteristics, and biogeographical ranges, the cinders clearly influenced the resource potential of the landscape as well as presenting environmental challenges to human populations.

The mesolandscape can further be characterized as consisting of a series of

variables, such as soil types, vegetative cover, and underlying geology, the intersecting values of which reflect depositional environments or microlandscapes. An example may be necessary at this juncture. Any point within a landscape, regardless of size or configuration, exhibits the interaction of atmospheric, hydrologic, geologic, and biotic factors. Disentangling these is neither simple nor straightforward. Atmospheric factors include, but are not limited to, seasonal and daily temperature fluctuations; direction, intensity, and variability of winds; amounts of solar radiation; and precipitation patterns. Similarly, geologic characteristics incorporate elevation, underlying geology, geomorphological structure, soils, water transport and drainage patterns, and erosional processes. Finally, biotic considerations cover past and present vegetation, biogeographical radiation, and changes introduced by human technologies. Further complicating the situation, all of these variables must be seen as components of dynamic rather than static ecological systems. The problem, then, becomes one of examining agricultural use of microlandscapes in terms of both individual variables and their attendant values as well as sets of linked variables. In other words, agricultural fields were situated so as to utilize specific land forms, soils, and subsurface water in conjunction with sufficient temperature and precipitation. Therefore, determining patterns of agricultural decision-making in regard to choice and sequence demands the use of measurable variables that can be compared in a systematic fashion (Butzer 1982).

With the above discussion in mind, eight environmental variables have been selected for measurement. Taking into account the range of hierarchical levels these include (1) upland/lowland differences, (2) land classification units, (3) underlying geology, (4) soil zones, (5) vegetation zones, (6) hydrology, (7) characteristics of precipitation, and (8) temperature. Each variable, along with the tabulated frequencies of agricultural elements, will be examined further on in this chapter. In addition, characteristics such as wind, solar radiation, and aspect or orientation will be discussed where appropriate.

Settlement Context

Given the detailed discussion of settlement systems in Chapter 5, only a few, brief statements regarding settlement context are necessary. As with the environment, the settlement landscape can be structured into macro through micro levels. The macro or regional settlement landscape mirrors the environment in both extent and variability. Composed of settlement forms ranging from small, seasonally occupied field structures to aggregated pueblos, the Flagstaff region displays a relatively lengthy and complex prehistoric record. In general, however, the region contains few large-scale settlement clusters, exhibiting instead small pithouse villages located during the early stages of settlement near open park-like settings and then, somewhat later on, small-to-medium sized unit pueblos surrounded by a variety of functionally diverse structures. More than anything else these patterns reflect experiments in high-altitude living, wherein population size, architecture, settlement structure, subsistence, and group organization were adjusted according to resource availability and regional interaction.

Being somewhat anomolous, Wupatki emerged in conjunction with the fortuitous eruption of Sunset Crater and local to regional shifts in subsistence-settlement organizations (Pilles 1974, 1978, 1979). Lo-

cated on what has been termed the "frontier" of Sinagua culture (Colton 19442

, 1968), settlement at Wupatki took on a slightly different character than did either preceeding or contemporaneous surrounding communities. This mesolandscape exhibited two predominant, but quite dissimilar, settlement clusters--the Wupatki and Citadel communities--thatcorrespond to the upland/lowland dichotomy already discussed. Whether or not this represents geographical radiation of the same community, competing political entities, or simply autonomous village units remains problematical. What seems clear, though, is that the Wupatki and Citadel communities, along with others in the immediate vicinity, played a fundamental role in the settlement landscape of the Flagstaff region.

Associated with the major settlements were somewhat smaller, scattered locales composed of unit pueblos, fieldhouses, granaries, resource areas, water conservation devices, and agricultural fields. Creating a pattern of microlandscapes within the wider upland/lowland mesolandscape, these smaller components reveal critical aspects of technological, organizational, and land-use experimentation through time.

Unlike the contextual analysis detailed for environmental variables, the relationship between the agricultural and wider settlement system requires a more impressionistic form of investigation. Therefore, the spatial extent and configuration of the agricultural landscape, along with the relevant settlement components, will be described according to chronological phases. The intent, therefore, is not only to measure the overall geographical extent of settlement and agriculture, but also to identify its organization and evolutionary characteristics.

Archeology of the Prehistoric Agricultural Landscape

The prehistoric agricultural landscape preserved at Wupatki National Monument is composed of an array of field systems designed to control and manage an arid natural environment. Comprised of over 12,000 individual elements or features, these fields lie scattered across exposed mesa tops, cinder-covered slopes, flat grasslands, and in seemingly barren, desiccated washes. The variety of field shapes, sizes, construction formats, and locational situations appears bewildering at first. Upon more detailed examination, though, a consistent pattern of field types, characterized by definable groupings of field elements, emerges. Although somewhat arbitrary given the impressionistic data available, the field types exhibit technological configurations, which when combined with distributional characteristics, illustrate aspects of agricultural decision-making, organizational strategy, and ecological adaptation. Ultimately, then, the agricultural landscape provides integral information for any evaluation of systemic success or failure.

Before addressing the analytical and interpretive issues posed above, the agricultural landscape must be conceptually reconstructed. This entails defining and describing the components of prehistoric agricultural technology in a systematic fashion. Therefore, this section will examine the types of field elements and systems found at Wupatki along with a detailed coverage of both general and specific distributional characteristics.

Field Elements

Field elements, defined as any feature resulting from the construction, modification, and/or maintenance of agricultural fields, make up the initial components or building blocks of prehistoric agriculture. While basically similar in terms of construction technology, field elements exhibit considerable morphological and functional diversity. At Wupatki eight field element types have been identified: (1) rock piles, (2) rock pads, (3) rock semicircles, (4) rock alignments, (5) terrace walls, (6) check-dams, (7) cinder berms, and (8) individual upright stones. Further variability in construction details and spatial placement appear in the element types themselves, suggesting sophisticated decision-making within a relatively simple agricultural technology.

Perhaps the easiest to define but most difficult to interpret of the field elements are rock piles (compare with Masse 1979:164-167). Quite simply, rock piles are concentrations of rock ranging in size from roughly 20 cm to well over 1 m in diameter and up to 75 cm in height. In general, rock piles were constructed from the prevailing surface stone--such as limestone, sandstone, basalt, or more rarely river cobbles--available in the surrounding area. Frequently, however, these materials were used in combination: the majority of the stones were of one type, and dissimilar stones were added at the apex of the rock pile. Configuration or shape also varied from simple clusters of cobbles, often piled in a conical or pyramidal form, to complex rock piles containing a well-prepared base, graduated cobbles, and a central upright monolith. Spatially, rock piles occur either individually or in groups, within or outside of clearly defined fields; therefore, they present the possibility of multiple functions.

Basically, rock piles located within fields may have functioned as boundary markers designating land use (Woodbury 1961:24), to stabilize and prevent erosion of rock alignments at critical points, to provide foundation support for the prehistoric equivalent of scarecrows (Beaglehole 1937:42), as portions of field shrines (Beaglehole 1937:39), to protect individual plants from severe wind damage (Forde 1931:409), or simply as areas where field rock was dumped to get it out of the way (Woodbury 1961:12; Lindsay 1961:183). Clearly, then, a given field could have exhibited any or all of these types of rock pile as components of a functioning system. In contrast, rock piles located outside of fields, especially when found in isolation, may have served a nonagricultural function such as trail markers, territorial boundaries, locational devices, as part of a sight-line, or shrines (Forde 1931:366-367). Unfortunately, and despite the inferences that may be drawn from spatial location, most rock piles lack sufficient morphological characteristics to determine function with any certainty.

Occurring with much less frequency than rock piles, rock pads consist of clusters of stone, invariably one course high, that differ in size, shape, and location within a field. The rock pads examined ranged from rectangular to roughly circular, approximately 1 to 2 in diameter, and they were usually located within rather than on the margins of fields. Composed of medium-sized cobbles obtained from the surrounding area, rock pads exhibit minimal morphological structure and rarely contain an admixture of materials. Given these characteristics, rock pads may be collapsed

rock piles, concentrations of cleared field rock, field shrines, or primary processing areas associated with agricultural activities. Although all of these functional interpretations seem possible, the last one appears most likely from the standpoint of the rock pad creating a relatively flat, clean surface upon which to carry out a variety of activities within the boundaries of a field. Rock pads have very limited distributional occurrence in the agricultural landscape. While problematical, this distribution could reflect changes in subsistence technology, longevity of field use, greater distance from primary habitations, or variation in planted domesticates.

Another field element often seen within the boundaries or on the very periphery of fields is the rock semicircle, an arc-shaped alignment of stone generally one course wide and 1.5 to 3 m in diameter. As with all other field elements, the semicircles are constructed of locally available materials with very little mixing and aligned in such a fashion that the open end faces northeast, away from prevailing winds. Woodbury (1961:14) describes features of this sort as "crude windbreaks, semicircular walls of stone probably never more than a few courses high. They may have been roofless, or have had simple roofs of brush added from season to season as their use required." Excavation of a semicircular windbreak at Point of Pines revealed an arc-shaped stone wall that may have been as much as five courses in height and clearly substantial enough to provide limited shelter (Woodbury 1961:24). Further analogous evidence for the morphological and functional characteristics of field shelters can be seen in V. Mindeleff's (1891:218) description of the Hopi kishoni--a small structure of upright wooden posts and brush providing a simple shelter for the duration of the planting season--and Beaglehole's (1937:39) discussion concerning the use of the kisi, or field hut, "to smoke and breathe prayers for rain."

Rock alignments, constituting the vast majority of all field elements at Wupatki, exhibit substantial diversity in material composition, construction techniques, size, shape, spatial configuration, and density. While generally constructed of locally available stone, alignments tend towards greater mixing of materials than other field elements. Similarly, construction techniques vary considerably depending upon the specific environmental setting and functional requirements of a given alignment. Morphologically, alignments consist of a row of stones lain side by side, usually one course wide and never more than two courses high. Variations, however, are seen in the addition of upright stones, rock piles, and small buttresses into the fabric of the alignment that presumably furnished increased durability and functional reliability. The length of alignments ranges from around 1 to well over 100 m for shapes that include linear, slightly wavy, curved or contoured, and intersecting. Spatial configurations, the placement of one alignment in relation to another, also differ on the basis of functional requirements. These include (1) parallel sets running across slopes, down slopes, or on flat terrain, (2) contoured parallel groupings that follow a topographic gradient, (3) intersecting alignments that create a grid pattern of square, rectangular, or trapezoidal plots, (4) triangular diversion alignments, (5) long foundation grid alignments with smaller alignments footed into the main one perpendicularly, and (6) in configurations that appear to have no pattern whatsoever. Finally, the density of rock alignments can range from a few isolated alignments to literally hundreds, organized into complex field configurations.

Functional interpretations of rock alignments are somewhat clearer than those

of other field elements. Because alignments arranged into groupings are more easily recognizable as agricultural elements, their specific functions can be identified with greater reliability. Therefore, alignments within agricultural fields facilitated water control (Winter 1978:94-97; Lindsay 1961:181; Doolittle 1984:127-132), field clearance (Doolittle 1984:129), soil and water conservation (Woodbury 1961:12-13; Lindsay 1961:181-184; Lindsay 1970:5; Plog and Garrett 1972), erosion control (Forde 1931:363), wind protection (Hack 1942:33; Beaglehole 1937:41; Lindsay 1961:184), boundary designation (Berlin et al. 1977:590; Woodbury 1961:24), garden plot maintenance (Hack 1942:30), and heat conservation/intensification (Pilles 1981:10). As with rock piles, any given alignment could have provided many of the above functions simultaneously.

Seen in only a few locations at Wupatki, terraces represent a specific type of alignment built to collect and maintain soil behind a relatively substantial wall, creating a fairly level surface of varying dimensions and soil depth (Hack 1942:37; Lindsay 1961:181). Characteristically, terrace walls exhibit masonry two or more courses wide that at times exceeds 1 m in height. Two forms of terrace, reflecting slightly different functions, have been identified within the monument. The first consists of parallel walls running across or perpendicular to a slope so that runoff carrying silt may be trapped as it moves downslope. Since parallel terrace walls tend to be quite lengthy, a sizable amount of arable soil could then accumulate in a fairly restricted space. The second type of terrace wall is smaller than the parallel forms and generally circular to subrectangular. Constructed with the downslope wall higher than its upslope counterpart, these miniature garden or terrace plots usually contain a combination of soil and household trash. Occasionally, terrace plots are built up against a large outcrop or cliff face, indicating efforts to control numerous environmental variables.

Similar to terraces in function and morphology, but not topographic location, are checkdams. Predominantly found in the basin lowlands along intermittent drainages, checkdams are small walls of various size constructed of stacked sandstone and/or basalt blocks keyed into the adjacent talus and set perpendicular to the drainage gradient. Most observers agree that the function of a checkdam was to trap and retain soil while at the same time slowing runoff to a point where some of it would soak into the ground (Woodbury 1961:12; Rohn 1963:442; Hayes 1964:76-77; Winter 1978:89). More recent evaluations (Woosley 1980; Doolittle 1985), however, challenge this interpretation on the basis of morphological and distributional characteristics, noting instead the role check-dams play in controlling the dynamic qualities of soil and water. According to this interpretation, checkdams were constructed primarily to control slope wash and protect fragile fields rather than specifically acting to trap arable soils. Overall, the limited distribution and spatial context of these elements seems to support the latter hypothesis.

Identified at only one spot just north of Antelope Wash, cinder berms constitute yet another, albeit unusual, field element. Aligned in a grid-like pattern, the individual berms are constructed of linear cinder hills around 1.5 m in height that enclose roughly 2 by 3 m rectangular plots. Morphologically similar to Zuni waffle gardens (Mindeleff 1891:216; Kintigh 1985:96-102), the cinder berm field located near the eastern margin of Antelope Prairie contains no less than six well-preserved farming plots. Functionally, this field would have provided soil and water conservation as well as affording substantial

wind protection for seedlings. Therefore, the cinder berm field presents an ideal technology for flat, exposed areas characterized by low rainfall and high winds. Unfortunately, only the barest of archeological evidence for cinder berms has survived, probably because they have been the victim of extensive wind and water erosion.

Upright stone boulders of basalt, limestone, or sandstone represent the final prehistoric field element recognized at Wupatki National Monument. Identified in only a few fields, upright stones appear in association with rock piles and alignments, or as isolated elements. Typically, the uprights are set into the ground so that the long axis of the stone projects well above the surrounding landscape, presumably providing a locational marker that may have been painted or carved with identifying glyphs. Woodbury (1961:14, 24) describes similar features at the Rocky Point Farm site (Arizona W:10:108), wherein he cautiously suggests that the uprights served as field boundary markers in conjunction with more perishable materials. Substantive ethnographic observations from the late nineteenth and early twentieth 20th centuries (e.g., Mindeleff 1891:188; Titiev 1944:62; Cushing 1920:125, 153; Forde 1931:367; Forde 1949:233-234) support this conclusion.

For all of their diversity, the field elements described above reflect a relatively simple agricultural technology in which soil and water conservation were the primary considerations. When examined within the structure of patterned fields, however, the simple rock features gain in complexity as components of a specific field system operating to manage a portion of the wider landscape. With this in mind, field systems may be classified in terms of their technological, functional, and environmental characteristics, all of which are critical to an understanding of the agricultural landscape and ecology.

Field Systems

Numerous authors (e.g., Hack 1942; Stewart and Donnelly 1943; Woodbury 1961; Lindsay 1961; Martin and Plog 1973; Vivian 1974; Winter 1978; Glassow 1980) have classified prehistoric agricultural fields on the basis of morphology, environmental location, and inferred function. Virtually all of these efforts identified a sequence of field types ranging from rather simple akchin, or flood water plots, to technologically complex terrace systems. The present examination, while generally corresponding with these earlier classifications, expands upon them by employing a detailed attribute analysis of 41 fields within Wupatki National Monument (Fig. 4.1). Although the fields were not randomly selected, and the measured attributes portray only a fraction of those available, this approach has the advantage of providing certain classes of information heretofore unavailable. This information is summarized in Table 4.1.

Seven field system types, reflecting increasing levels of landscape modification, were recognized at Wupatki. These include (1) rock pile fields, (2) simple fields, (3) bordered fields, (4) bordered gardens, (5) composite fields, (6) terrace gardens, and (7) terrace fields. Other field types exhibiting little or no archeological evidence--such as the cinder berm field previously described or flood water fields--no doubt existed, but their relative use as technological choices within the agricultural system remains unclear.

Being the simplest field type in terms of element morphology and physiographic

FIGURE 4.1. Agricultural Fields Sample

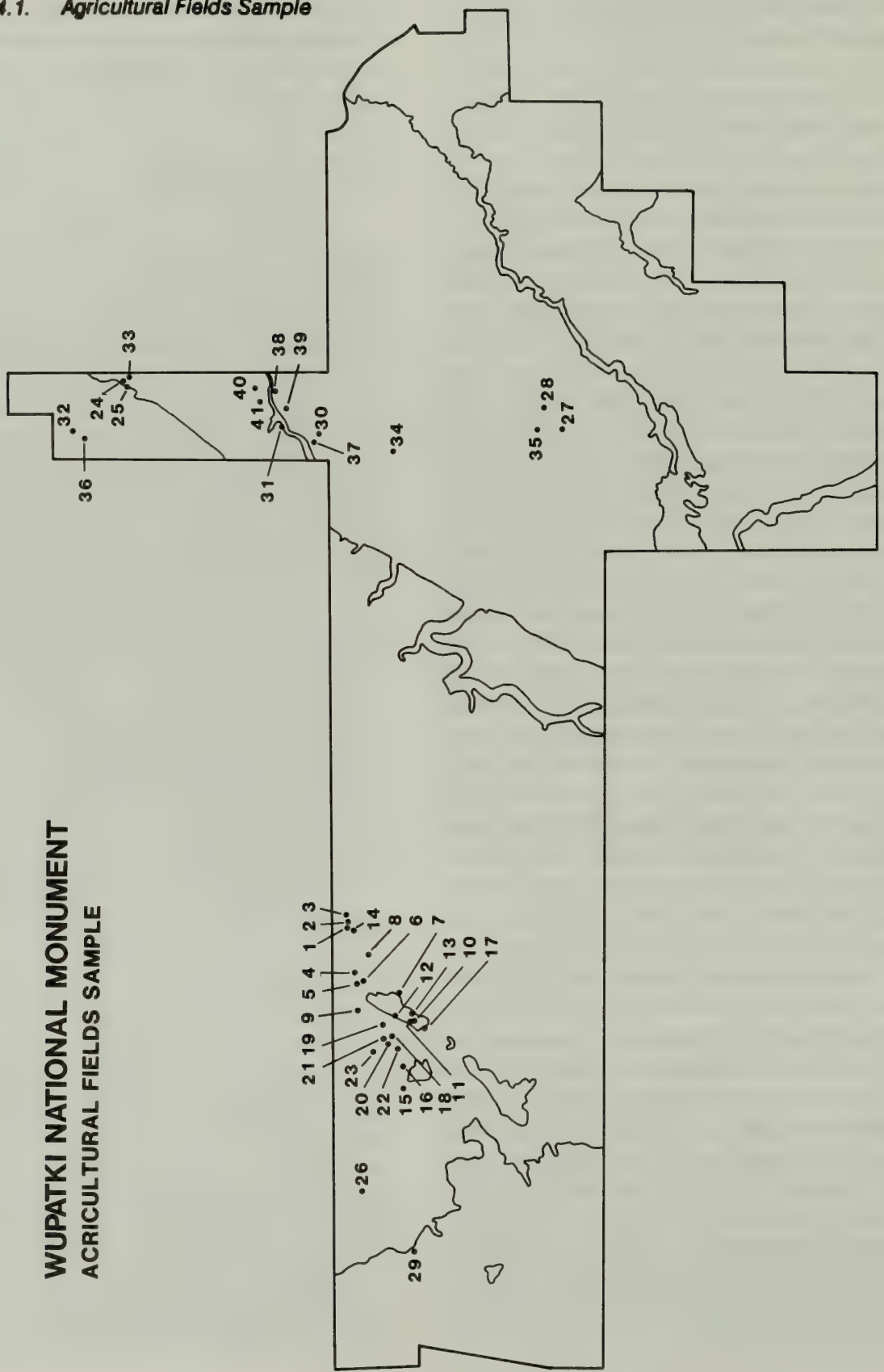


TABLE 4.1. Summary of Field System Sample

#	AREA	TYPE	ELEV.	EXP	% SLOPE	LAND CLASS	WIND EXP	PREC	SOIL	SIZE SQ. METERS	FEA. #	DIS TO NEAREST FS	DIS TO NEAREST PUEBLO
1.	Upland	Composite Field	5355'	SW	10-15	Slope	Mod	6-10"	1A	8400	58	15 METERS	50 METERS
2.	Upland	Composite Field	5340'	S	10	Slope	High	6-10"	1A	8255	49	40 METERS	100 METERS
3.	Upland	Bordered Field	5350'	SW	10	Slope	Mod	6-10"	1A	5600	27	40 METERS	50 METERS
4.	Upland	Bordered Field	5360'	SE	3-5	Slope	Low	6-10"	1B	3150	14 plots	50 METERS	775 METERS
5.	Upland	Bordered Field	5370'	S	10	Slope	Low	6-10"	1A	528	38 plots	50 METERS	580 METERS
6.	Upland	Simple Field	5370'	--	--	Flat Wash	Mod	6-10"	1A	2625	31	110 METERS	640 METERS
7.	Upland	Composite Field	5390'	S	5	Slope	Mod	6-10"	1B	4275	134	35 METERS	120 METERS
8.	Upland	Bordered Field	5330'	--	--	Flat Wash	High	6-10"	2A	484	11	76 METERS	575 METERS
9.	Upland	Composite Field	5320'	NW	10	Canyon	Mod	6-10"	3B	1950	32	50 METERS	100 METERS
10.	Upland	Terrace Garden	5440'	SE	25	Slope	Mod	10-16"	1A	504	5 plots	75 METERS	----------
11.	Upland	Terrace Garden	5440'	E	25	Slope	Low	10-16"	1A	1040	8 plots	75 METERS	----------
12.	Upland	Bordered Field	5440'	W	10-15	Slope	High	10-16"	1A	720	13	18 METERS	200 METERS
13.	Upland	Terrace Garden	5420'	SW	10-15	Slope	Mod	10-16"	1A	360	5 plots	100 METERS	----------
14.	Upland	Terrace Garden	5360'	S	3	Slope	High	6-10"	1A	280	9 plots	90 METERS	----------
15.	Upland	Simple Field	5380'	--	--	Canyon	Low	6-10"	2A	8250	20	60 METERS	425 METERS
16.	Upland	Simple Field	5410'	--	--	Prairie	Low	6-10"	3B	1562	13	225 METERS	400 METERS
17.	Upland	Simple Field	5420'	SW	5	Slope	High	10-16"	1A	380	7	50 METERS	60 METERS

TABLE 4.1. (continued).

#	AREA	TYPE	ELEV.	EXP	% SLOPE	LAND CLASS	WIND EXP	PREC	SOIL	SIZE SQ. METERS	FEA. #	DIS TO NEAREST FS	DIS TO NEAREST PUEBLO
18.	Upland	Terrance Field	5400′	E	4	Canyon	Mod	6-10"	1B	336	11 plots	20 METERS	110 METERS
19.	Upland	Composite Field	5340′	S	0-5	Canyon	High	6-10"	1B	1800	43	50 METERS	210 METERS
20.	Upland	Composite Field	5390′	NW	0-30	Slope	Mod	6-10"	1B	3584	26	---------	175 METERS
21.	Upland	Composite Field	5420′	W	10	Slope	Mod	6-10"	1B	1110	32	24 METERS	35 METERS
22.	Upland	Bordered Field	5380′	SW	0-5	Prairie	High	6-10"	1B	3600	27	50 METERS	60 METERS
23.	Upland	Rock Pile Field	5360′	--	--	Prairie	Mod	6-10"	3B	73,500	31	45 METERS	200 METERS
24.	Lowland	Bordered Garden	4520′	S	10-15	Sandstone	Mod	6-10"	2C	96	10 plots	350 METERS	350 METERS
25.	Lowland	Bordered Field	4540′	S	10-15	Sandstone	Mod	6-10"	2C	592	8	200 METERS	200 METERS
26.	Upland	Bordered Field	5440′	NW	28	Slope	High	6-10"	4H	240	15	65 METERS	425 METERS
27.	Lowland	Bordered Field	4720′	E	3	Slope	Mod	6-10	2H	3500	21	50 METERS	925 METERS
28.	Lowland	Sample Field	4640′	--	3	Sandstone	Mod	6-10"	2H	561	13	30 METERS	1200 METERS
29.	Upland	Simple Field	5465′	E	3-3	Ledge	Low	10-16"	3B	1080	21	200 METERS	550 METERS
30.	Lowland	Bordered Garden	4570′	SE	5	Mesa	Mod	6-10"	3E	2100	29 plots	375 METERS	150 METERS
31.	Lowland	Bordered Field	4480′	N	5	Mesa	Low	6-10"	2C	900	24	35 METERS	150 METERS
32.	Lowland	Bordered Field	4820′	S	0-3	Escarpment	Low	6-10"	3E	4352	28	200 METERS	1100 METERS
33.	Lowland	Bordered Garden	4500′	E	--	Prairie	Low	6-10"	2C	1200	6 plotss	250 METERS	250 METERS
34.	Lowland	Simple Field	4640′	--	3	Sandstone	High	6-10"	2C	37,500	49	175 METERS	500 METERS

TABLE 4.1. (concluded).

#	AREA	TYPE	ELEV.	EXP	% SLOPE	LAND CLASS	WIND EXP	PREC	SOIL	SIZE SQ. METERS	FEA. #	DIS TO NEAREST FS	DIS TO NEAREST PUEBLO
35.	Lowland	Bordered Field	4680'	E	15	Slope	Low	6-10"	2H	9900	53	98 METERS	1250 METERS
36.	Lowland	Terrance Field	4820'	NE	15-30	Escarpment	Low	6-10	3B	12,934	50	250 METERS	1375 METERS
37.	Lowland	Composite Field	4600'	--	0-3	Mesa	High	6-10"	3E	45,000	202	----------	----------
38.	Lowland	Bordered Field	4420'	--	0-10	Canyon	Low	6-10"	2C	5580	53	----------	----------
39.	Lowland	Composite Field	4510'	--	0-20	Mesa	High	6-10"	3E	22,000	191	----------	400 METERS
40.	Lowland	Simple Field	4460'	--	--	Mesa	High	6-10"	3E	42,000	90	----------	975 METERS
41.	Lowland	Bordered Field	4480'	--	--	Mesa	High	6-10"	3E	50,400	146	----------	725 METERS

KEY

EXP - Exposure
WIND EXP - Wind exposure
PREC - Precipitation
FEA # - Number of elements within field
FS - Field structure

land use, rock pile fields are composed of variably spaced rock piles that show little pattern or consistent orientation. The single example examined in the analysis (Field System 23) exhibits a series of rock piles, roughly aligned eastwest, that apparently bounded an area over 18 acres in extent, only a portion of which was probably farmed during a given year. Located at the head of Box Canyon on flat, open terrain, this field also contained a few rock pads, a scattering of alignments, and a single field structure (Fig. 4.2). To the southeast, a number of more complex fields ran down the slopes of Middle Mesa. From this example, as well as others examined more casually, it appears that rock pile fields were predominantly placed at drainage heads on slopes of less than 5%. Functionally, the individual rock piles apparently served to demarcate boundaries, the location of field shrines, or piles of cleared field rock; or as simple windbreaks. Situated in close proximity to habitation sites, and with considerable numbers of seasonally occupied field structures nearby, these fields seem to reflect prolonged use of areas requiring little agricultural modification and maintenance, and as such they recall the dryland farming strategies described by Glassow (1980:45). In general, then, rock pile fields represent a widespread, but poorly defined, field type distributed primarily in the upland portions of the monument.

Simple fields, examined on the basis of six fields from both the uplands and lowlands, consist of closely spaced, parallel rock alignments with at times widely dispersed ancillary elements. Occasionally, simple fields incorporate small sets of gridded alignments, rock pile borders, rock pads, and field shelters. The size of simple fields tends to be relatively small, ranging from 0.1 to over 10 acres and averaging

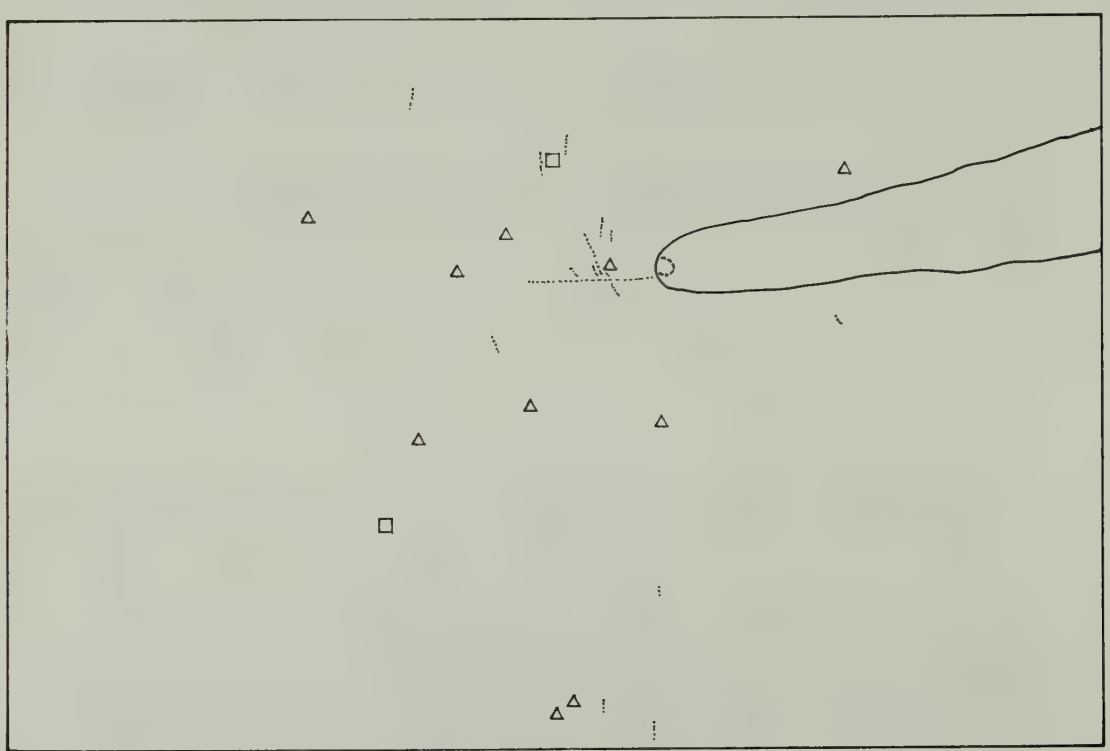


FIGURE 4.2. Field System 23 (△ - Rock Pile, □ - Rock Pad).

slightly more than half an acre, with few instances of clustering in any area of the Monument. Although similar to rock pile fields in the utilization of less than 5% slopes, simple fields employed a wider sphere of physiographic settings, including drainage heads, gentle slopes, mesa tops, and flat plains in both upland and lowland areas. Field System 6 (Fig. 4.3) depicts a well-preserved simple field located on top of a sand dune between North Mesa and East Mesa. Constructed of a series of parallel alignments running northwest to southeast across the top of the dune, Field System 6 provides an example of a simple field designed for wind protection and soil stabilization. Additional elements, including rock piles and border alignments, possibly indicate a longer period of use and greater labor expenditure in the management of this field. More typically, simple fields appear as a limited number of alignments with few if any outlying field facilities. Field System 17 (Fig. 4.4), located on the flat between Citadel Mesa and East Mesa, exemplifies this type of field, wherein a group of seven alignments provided little more than wind protection. Hack (1942:70-71) refers to fields of this sort as sand dune fields where the alignments acted as wind breaks or foundation supports for brush fences. He goes on to say that sand dune fields may have been linked to other, nonagricultural activities and therefore represent opportunistic farming rather than the primary agricultural effort of a community. This may indeed be the case, given the lesser frequency of associated field structures and a tendency towards more distant field locations in relation to settlement.

Considerably more complex than rock pile or simple fields, bordered fields generally contain a variety of alignment configurations. These can range from limited

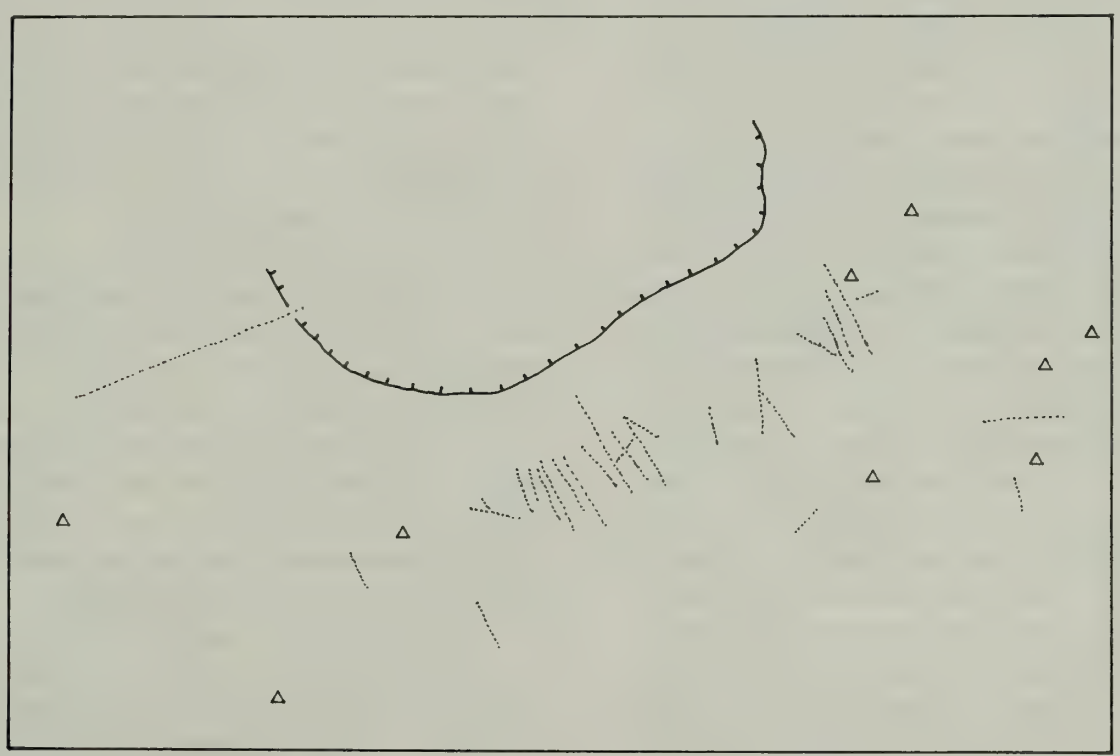


FIGURE 4.3. Field System 6

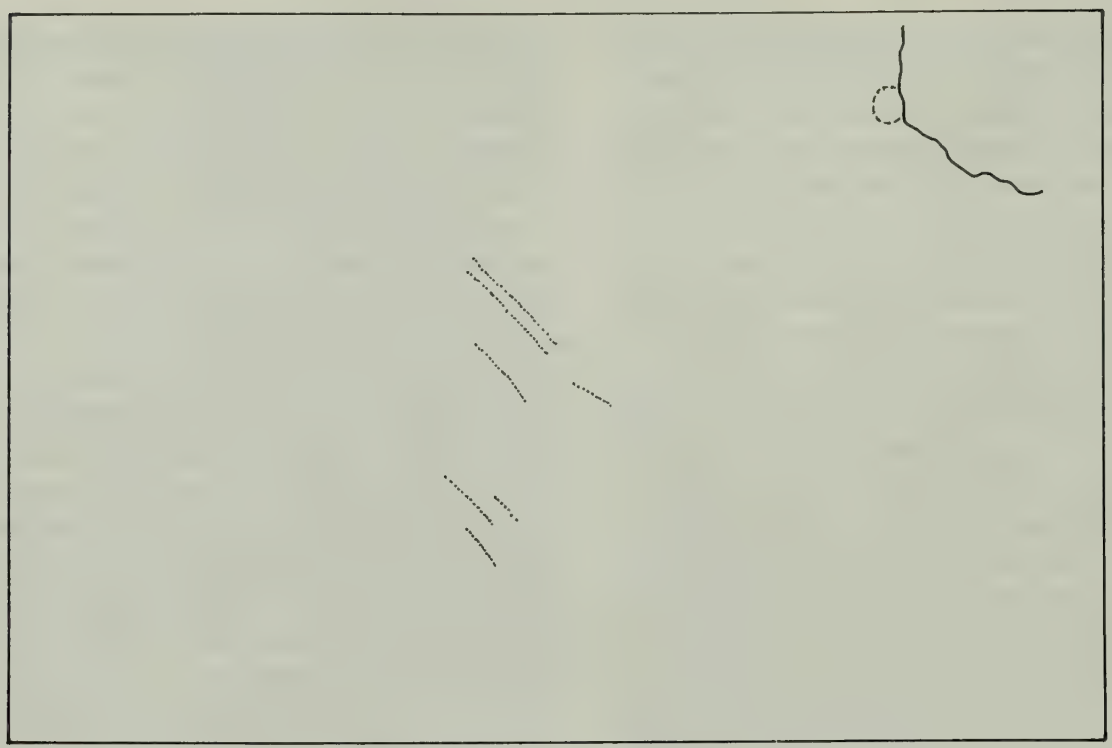


FIGURE 4.4. Field System 17

sets of parallel alignments situated across (Fig. 4.5) or contoured (Fig. 4.6) with slopes, to foundation grid formats exhibiting partially bordered field plots (Fig. 4.7). Invariably, these fields include other facilities, such as rock piles, pads, field shelters, rock alignment borders, and nearby field structures, all of which indicate functional and behavioral complexity. Functionally, bordered fields afforded wind protection, soil and water conservation, water control, and stabilization of field surfaces. In particular, rock pads and field shelters present the possibility of primary processing at the field site itself. One unusual configuration consists of parallel rock alignments extending downslope until they converge on a cinder or sand dune (Fig. 4.8). In this case the alignments were utilized as water control devices directing slope runoff to what has been termed a slope wash field (Glassow 1980:47-48). Unlike the other field types, bordered fields were adapted to a plethora of physiographic and environmental conditions. Overall, this description follows very closely those given by Woodbury (1961:12-13), Lindsay (1961:181-183), and Glassow (1980:52-54) for linear borders.

Averaging 0.75 acre and located on slopes of 5 to 15%, bordered fields tend to exist in clusters that follow specific physiographic gradients in virtually every environment capable of sustaining agriculture. This widespread distribution helps to explain their morphological and functional variability, and certainly suggests that this field type constituted a major component of the prehistoric agricultural landscape.

Representing an easily recognized but infrequent field type, bordered gardens (Vivian 1974; Masse 1979:169-170) characteristically exhibit perpendicular, gridded alignments surrounded on all sides by an enclosing wall or border. This creates a

FIGURE 4.5. Field System 22

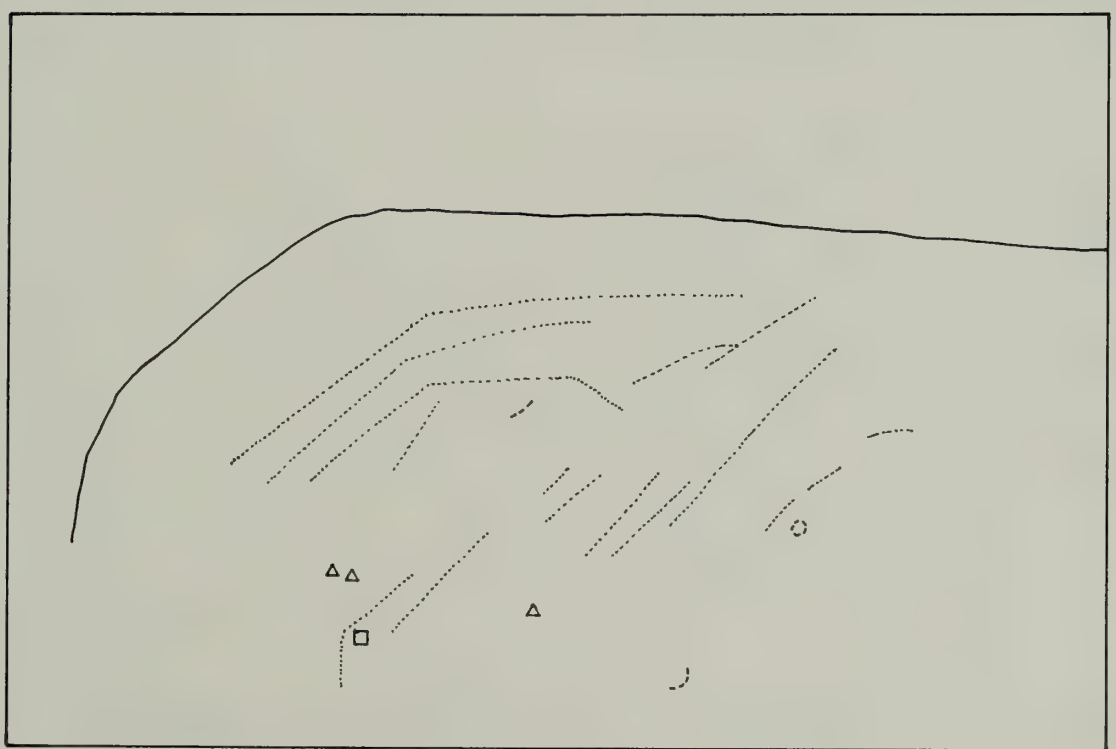


FIGURE 4.6. Field System 27

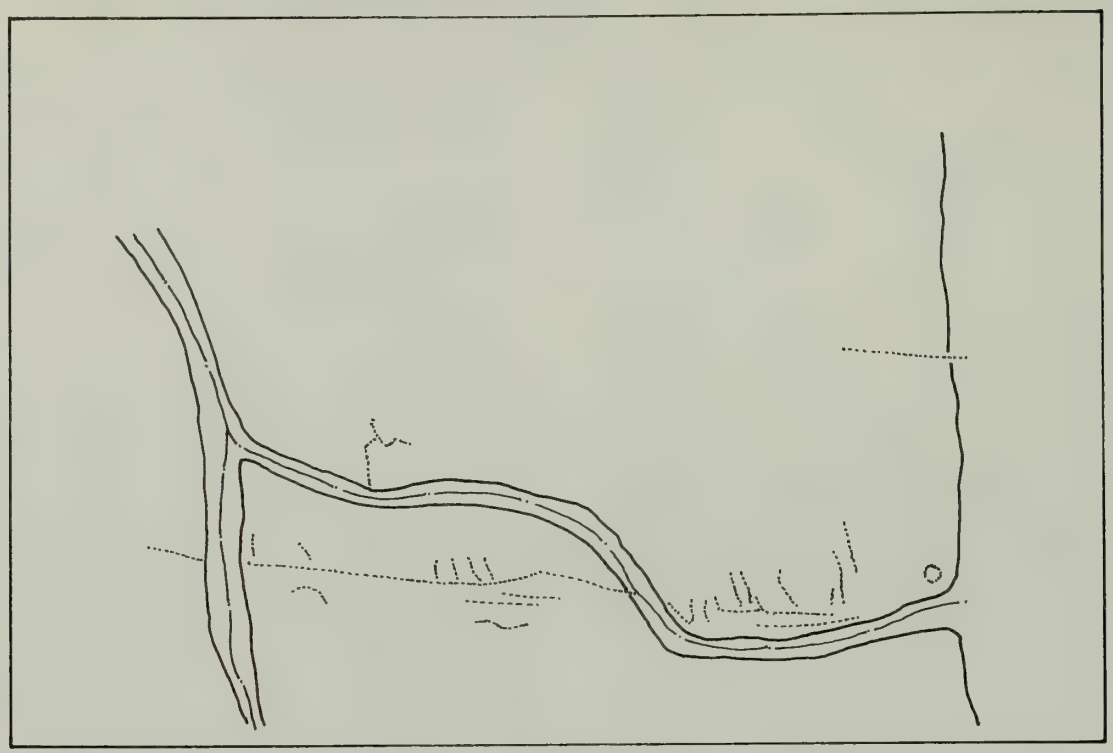


FIGURE 4.7. Field System 32

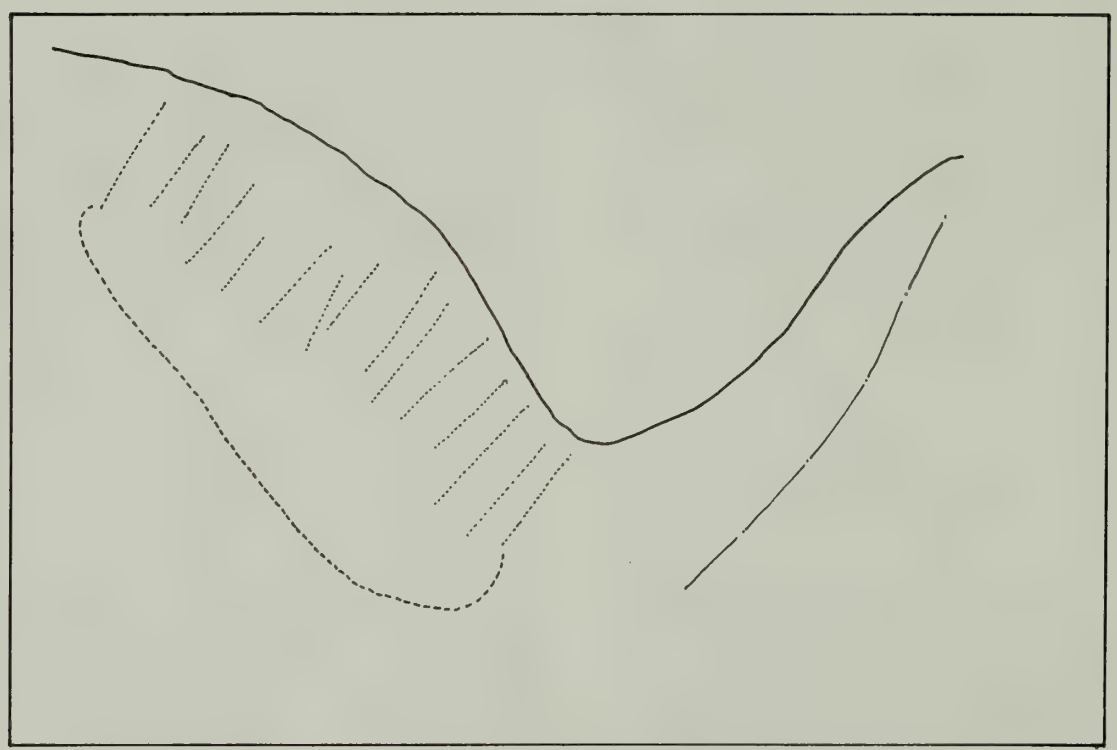


FIGURE 4.8. Field System 26

series of adjacent farming plots that considerably vary in both shape and size. Field System 5 (Fig. 4.9), presents an excellent example of a bordered garden gridded off into separate rectangular, trapezoidal, and triangular plots. Along the enclosing border, a few upright stones have been placed in positions suggesting field shrines or markers of land use, perhaps even ownership. Of the five bordered gardens examined in the sample, all appeared on bench-like slopes of 3 to 15%, with a mean field size of slightly more than one-third of an acre. Although having few small sites in the immediate neighborhood, most of the bordered gardens were relatively close to substantial habitation sites.

In functional terms, bordered gardens reflect an agricultural strategy concerned with soil and water conservation, enhancement of solar radiation, and intensive soil management through the addition of household trash. While a substantial effort must have gone into the selection, original construction, and continued maintenance of these fields, anticipating sustained yields year after year, their very infrequency suggests that they contributed minimally to overall agricultural subsistence; and were used instead for specific types of cultigens requiring continuous care.

One of the most complex field types, composite fields combine the entire range of element configurations thus far recognized. Frequently these fields (see Fig. 4.10, 4.11) incorporate parallel and contoured alignments, foundation grids, small bordered gardens, water diversion alignments, and rock piles in conjunction with processing and/or seasonal habitation areas. As with the bordered fields and gardens, composite fields lie on slopes of 5 to 15% in fairly restricted physiographic settings. However, unlike other field types, composite fields

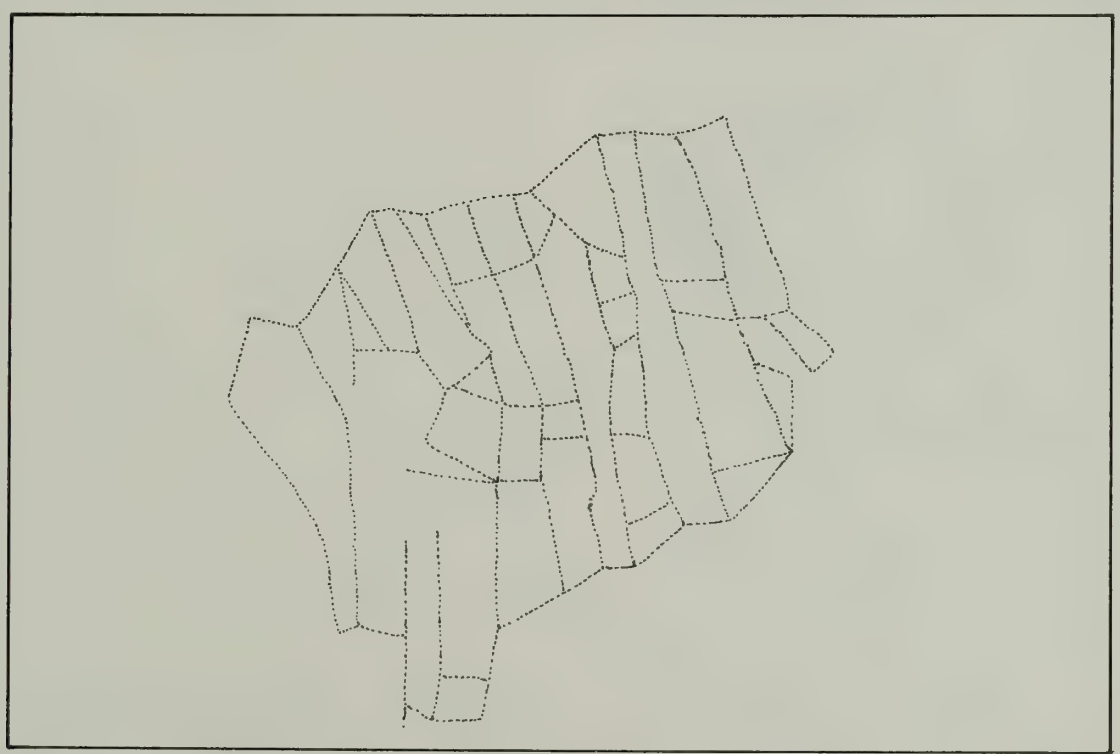


FIGURE 4.9. Field System 5

FIGURE 4.10. Field System 2

FIGURE 4.11. Field System 20

average around an acre, the largest in excess of 11 acres, making these the most extensive field type within the Monument. Further, compared to other field types, composite fields exhibit substantial numbers of nearby field structures within a 500 m radius and are generally located much closer to primary habitation areas. This observation suggests a greater expenditure in organizational costs as well as the possibility of long-term field use reflected through facilities modification and shifting areas of cultivation (Doolittle 1984). In many ways the characteristics and distribution of composite fields parallel observations made by Woodbury (1961:13) for grid borders. Of particular note is the comparatively limited distribution of grid borders, a situation similar to that seen at Wupatki, in which composite fields only show up in the vicinity of Lomaki Ruin and Citadel Wash, east of Doney Cliffs.

Partially described in "Field Elements", terrace gardens consist of walled plots, at times abutted against a natural outcrop, of around 3 m in diameter (Figs. 4.12, 4.13). These plots may be isolated or contiguous, circular to rectangular areas generally occurring in groups of less than 10 individual plots on slopes of 15 to 30%. All of the identified examples of this field type occur in association with pueblos, leading to the conclusion that the plots may have been carefully maintained household gardens. Therefore, while morphologically similar to bordered gardens, terrace gardens differ in terms of size, function, and agricultural utility. Winter (1978:94) describes field areas of this sort as mesa-top terraces where intensive cultivation of specialized domesticates occurred through pot-irrigation and soil composting.

Although only one terrace field was investigated in detail, there are numerous

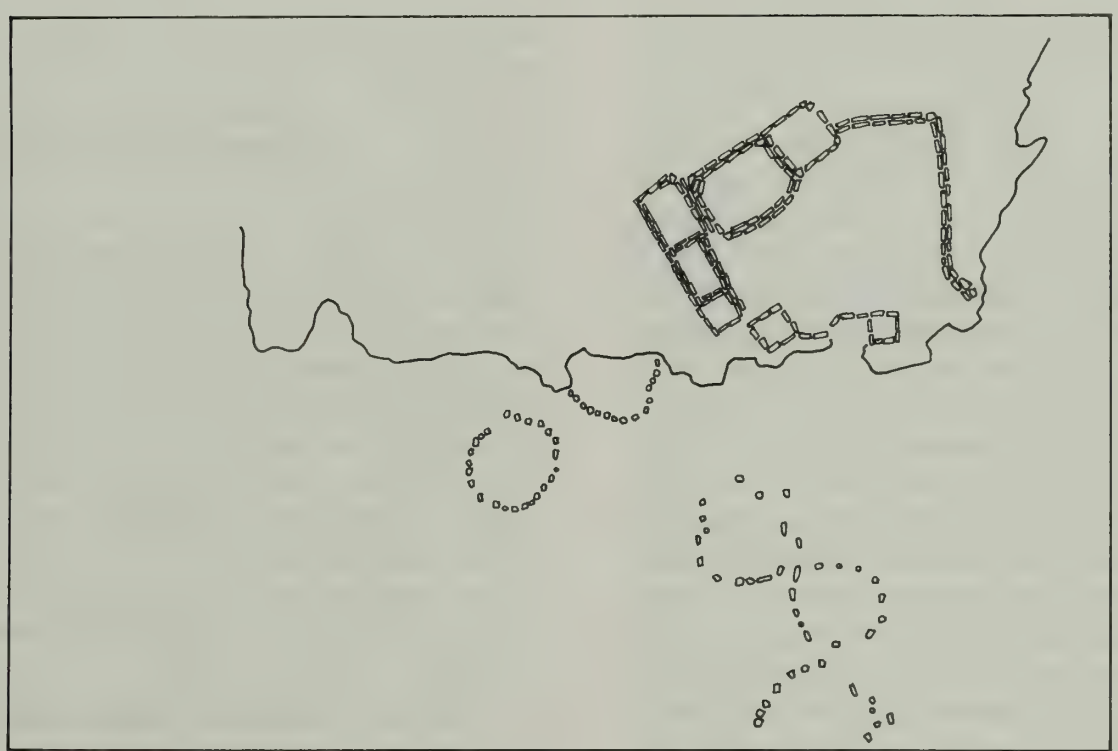


FIGURE 4.12. Terrace Garden

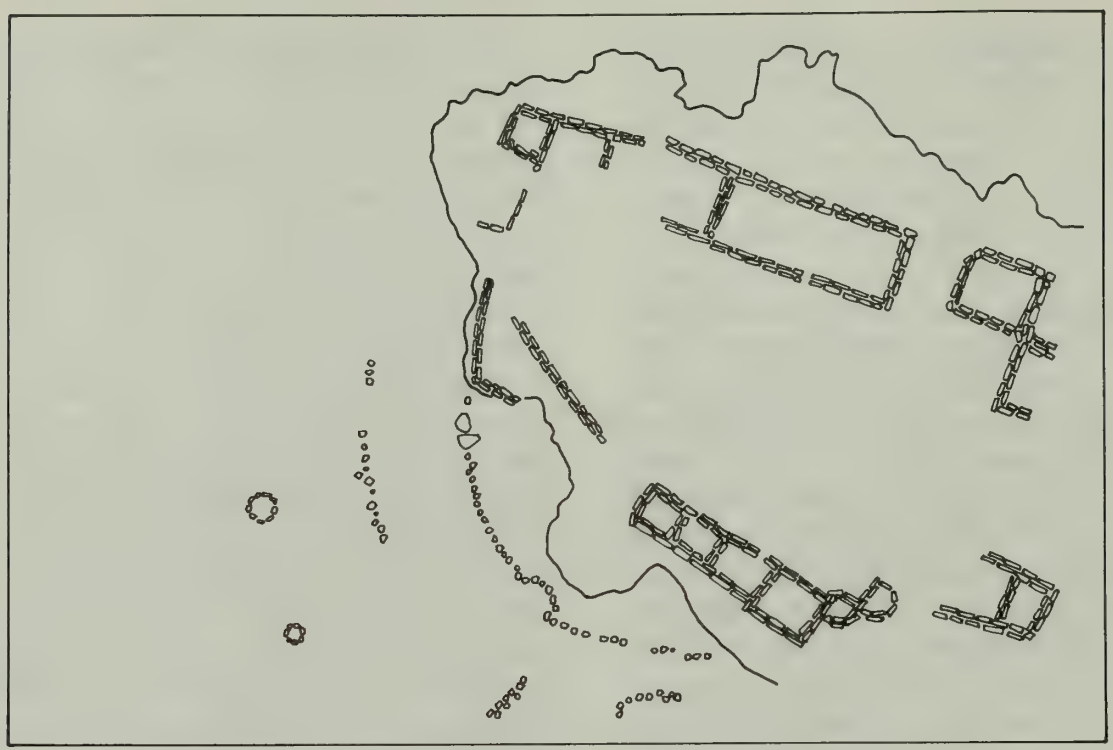


FIGURE 4.13. Terrace Garden

examples scattered throughout the Wupatki area. By definition, terrace fields, or what Vivian described as contour terraces (1974:97), exhibit closely spaced masonry walls running perpendicular to slopes of 15 to 30% in such a fashion that they impede hillslope erosion and provide a level terrace for planting. Located approximately 1 mile west of the Little Colorado River, Field System 36 (Fig. 4.14) consists of an integrated network of 13 terraces, some of which are over 170 m long, covering 3.2 acres along a boulder-strewn slope. As predicted by Woosley (1980:330-331), Lindsay (1961:181), and Doolittle (1985), smaller checkdams stabilized areas prone to erosion within the structure of the field. Just over a slight rise to the west, a composite field follows a large intermittent drainage until it intersects the northwestern end of the terrace field, while, at some distance to the east, a string of pueblos provided the only nearby habitation. From the standpoint of morphology and function, this field illustrates both an intensive and extensive approach to problems of agricultural conservation and, unlike the terraces described in most of the literature on the northern southwest (e.g., Woodbury 1961; Lindsay 1961; Glassow 1980), resembles the more complex trinchera systems of southern Arizona and northern Mexico. Given this, it seems probable that terrace fields represent the high end of the scale in regards to organizational requirements, possibly necessitating corporate work efforts for construction and maintenance.

In summary, the morphological and functional range of agricultural facilities recognized in the Wupatki area is truly remarkable. Substantial archeological evidence exists for seven field types, and another type is suggested by admittedly limited data, while a variety of other field

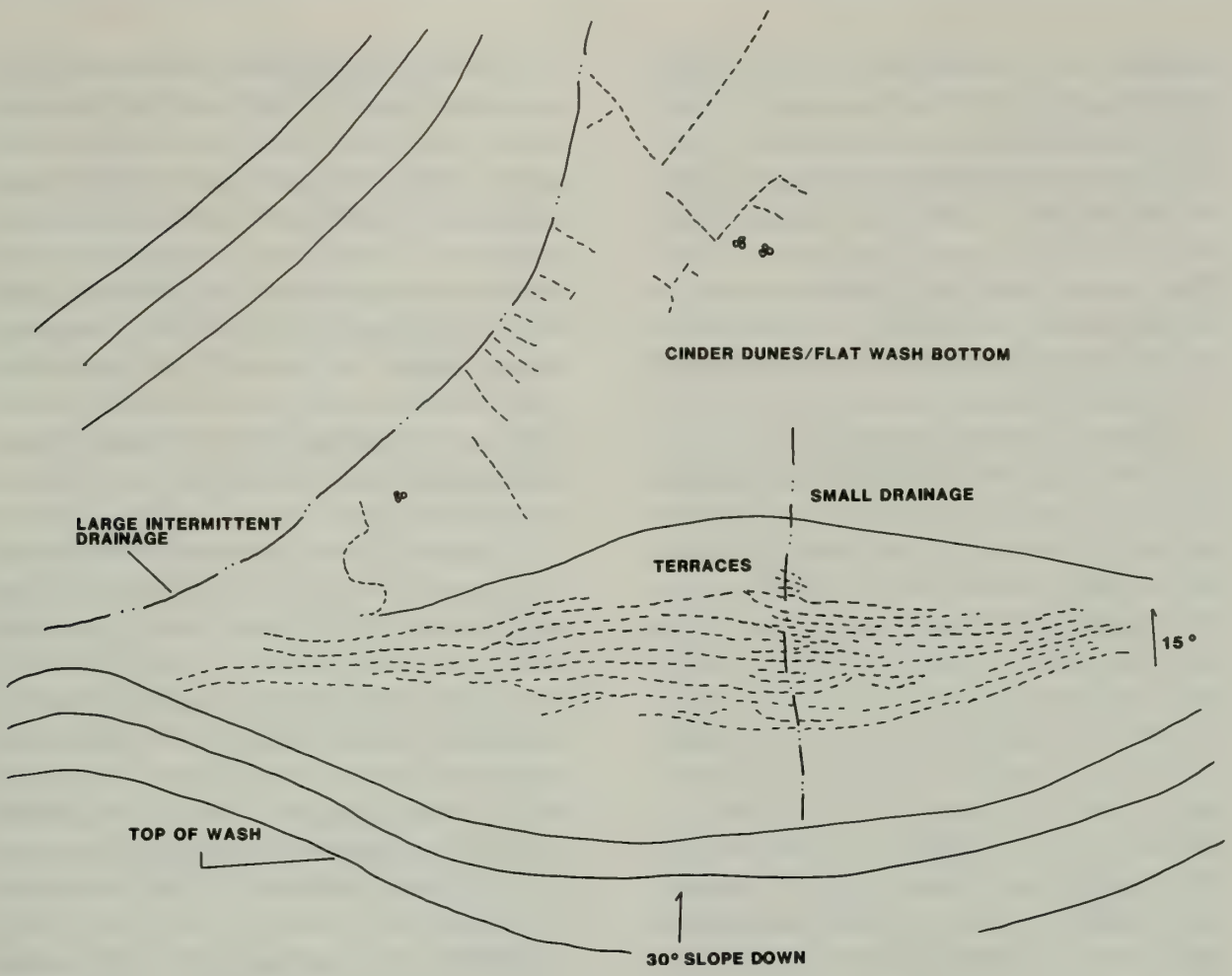


FIGURE 4.14. Terrace Field

systems leaving minimal archeological clues can at least be inferred. To varying degrees these fields were located on or close to flat plains, gradual through steep slopes, intermittent washes, sand or cinder dunes, and playa-like water catchments. This diversity reflects almost the entire spectrum of agricultural technologies presently identified for the prehistoric Southwest and more than anything else indicates an inherently flexible subsistence system.

Field Structures

The final component of the agricultural system is the field structure or house. From the earliest days of southwestern archeology numerous investigators have noted the apparent association between small sites and areas of agricultural potential (e.g., Mindeleff 1896; Colton and Colton 1918; Mindeleff 1891). Likewise, ethnographic observations of various groups such as the Hopis and Zunis consistently identified the existence of small shelters, granaries, and seasonal houses in proximity to agricultural fields (Mindeleff 1891; Beaglehole 1937; Hack 1942; Forde 1949; Cushing 1920). Since these initial observations, small sites have been identified throughout the prehistoric Southwest and invariably discussed in terms of their functioning as agricultural

facilities (e.g., Woodbury 1961; Lindsay 1961; Bradley 1959; van Valkenburgh 1961; Rohn 1963). Recent examinations (Ward 1978), however, are beginning to clarify the morphological, functional, and systemic criteria by which small sites are evaluated. This has resulted in a greater awareness of small site variability, wherein functional diversity, both agricultural and nonagricultural, appears characteristic.

Three discussions are particularly appropriate for differentiating the functions of small sites and their overall role in a wider settlement system. In examining the variation in Hohokam small structures, Crown (1985) compared the locational, architectural, spatial, and artifactual attributes of excavated prehistoric small sites with those identified ethnographically. After determining the range in historic functional variability--including fieldhouses, menstrual huts, fishing huts, purification huts, worker huts, sweatlodges, granaries, and elderly housing--she employed analogous models to hierarchically discriminate the function of prehistoric small sites. While recognizing the limitations of ethnographic analogy, this approach provided relatively explicit morphological criteria for determining site function. Similarly, Pilles (1978) assessed the morphological and functional variability reflected in small sites of Sinagua affiliation, the concern being to differentiate not only function but also seasonal versus permanent occupation. Based upon an analysis of 31 excavated sites, Pilles identified the morphological and artifactual characteristics of field structures while substantially revising interpretations of posteruptive land use, settlement, and demography. Finally, the theoretical statements of Wilcox (1978) concerning the relationship between small and large sites within subsistence-settlement systems expands our understanding of the functional complexity of fieldhouses as components of widespread agricultural strategies. This point is especially significant when attempting to differentiate and explain the pattern of small sites across a landscape. With these discussions in mind, and echoing the analyses of Downum and Sullivan in Chapter 5, the small sites related to agriculture can be classified according to general morphology and inferred function. However, this classification should be seen as tentative, and it will require considerable refinement in the future.

Basically, the small sites documented in the Wupatki area can be readily categorized into four types based on using gross morphological characteristics: (1) field shelters or huts, (2) rock shelters and enclosures, (3) single-room structures, and (4) multiroom structures. Each type exhibits considerable morphological variation reflecting functional, spatial, and environmental differences.

Already discussed in the section on field elements, field shelters are typically defined by their location within agricultural fields, simple architecture, and few associated artifacts. There are, however, enough measurable differences in size, shape, and artifact assemblage to indicate multiple field hut activities. Especially important in this regard is whether or not hunting occurred within or adjacent to field areas. Stahl (1982) presents convincing evidence that small mammals contributed substantially to the diet of prehistoric populations. Citing the high ratio of edible meat to live weight for insectivores and rodents and the fact that many human activities are invariably associated with these animals, he concluded that small mammals supplied a potentially important caloric resource. Agricultural fields, acting as highly desirable catchment-like habitats, would have provided just such an easily obtainable small mammal population (also note efforts

at experimental gardening in the Wupatki Basin by Maule 1963; Colton 1965; and Gasser 1979). Concurrently, the hunting of small mammals would have kept the same fields free of damaging pests during critical periods of the agricultural cycle. Therefore, it is not surprising that numerous field shelters contain evidence (e.g., small projectile points and retouched flakes) that suggests hunting as well as field protection.

Rock shelters and enclosures represent a morphologically indistinct site type characterized by the fortuitous utilization of natural overhangs and outcrops. Architecturally, there is little uniformity beyond the consistent use of rough walls, constructed with a variety of materials and techniques, to enclose space. Further, the paucity of surface artifacts undermines any effort to determine function from assemblage characteristics and often leads to unsupported speculations. Unfortunately, only one enclosure, reported in King (1949:159), has been excavated. Apparently dug by Charlie Steen, NA 1186 consisted of a 3 foot deep stone-lined circular pit abutted against the base of a limestone cliff. Although Steen indicated that this structure was "typical" of granaries, built against the low cliffs of the neighborhood," we are left to wonder about the legitimacy of this assessment. Thus, determining the function of structures of this sort--whether they be limited activity or processing sites, storage granaries, or fieldhouse--remains unresolved at this time. Nevertheless, the frequency and relative proximity of rock shelters/enclosures to agricultural fields indeed suggest their use as field facilities of one sort or another.

By far, the greatest majority of all small sites at Wupatki are isolated single-room surface structures characterized by shallow, circular to subrectangular, masonry-lined depressions, often with an entryway, and infrequent internal/external features. Three variations, as determined by the presence or absence of structural components, have been identified. The first consists of simple upright-slab and boulder foundations exhibiting neither entryways nor internal features. Usually, these structures contain little or no trash. They have minimal external features, they are circular, and they are frequently located close to habitation sites. NA 5701, excavated by Zorro Bradley and George Cattanach in 1955, is a good example of this type of structure. Built of upright slabs and coursed masonry walls 20 inches in height, NA 5701 revealed nothing beyond a slightly compacted floor surface and a single basalt hammerstone (Bradley 1959:13-14). Little can be said concerning wall or roofing details other than they probably compare with field shelters in material use and construction methods.

A second variation includes rectangular and U-shaped structures that exhibit a number of internal components (e.g., compacted floors, hearths, and postholes), but few if any external features. Entryways, when present, open towards the east, northeast, or north. Wall and roof construction, while based upon very slim evidence, apparently followed a consistent format of partial stone walls, four-post roof supports, and ramada-like brush roofing. Presumably, the interior could have been further protected by adding brush to the surrounding walls. Alternatively, Bradley (1959:16) suggests that structures of this sort might have been covered with earth and entered through the top; this construction providing a sealed, rodent-proof structure. Colton and Colton (1918:108), Bradley (1959:14-17), Van Valkenburgh (1961:4), and Ward (1978:138) all illustrate excavated structures of this sort in the Flagstaff area.

The final variation in single-room structure types is substantially more complex than those previously discussed, in

many ways adhering to earlier descriptions of what constitutes a fieldhouse (Pilles 1969). Morphologically, these sites are circular to subrectangular stone structures containing a variety of internal features, a well-defined east-facing entryway, external wing walls or ramada footings, at times a detached wall to the east, and abundant trash. Overall, and despite numerous examples of full-height walls, the general construction pattern of partial stone walls, four-post supports, and brush roofs remains characteristic. Where these structures differ from other single-room sites is in the elaboration of architectural features in conjunction with a greater frequency and diversity of associated artifacts. This certainly suggests that a wider range of activities, consistent with long-term seasonal occupation, may have been carried out at these small sites. Empirically substantiating what these activities were, however, will have to wait until analyses similar to those conducted by Pilles (1978) are completed. Notwithstanding, the proximity of complex single-room structures to agricultural fields, many in direct association, strongly indicates a functional correlation.

Given the morphological variation of single-room structures, we can assume a wide range of activities, only some of which were related to agriculture. While the identification of a specific structure with sets of activities, based upon questionable surface data and limited excavations, remains speculative, it seems reasonable to hypothesize that the single-room structures functioned as special activity areas (i.e., menstrual/purification huts, gathering stations, etc.), granaries, or fieldhouses. Therefore, the simplest single-room structures, particularly when found in association with larger sites, may have been used as specialized architectural spaces not involved with agriculture. Alternatively, the more complex single-room structures may have served as either storage granaries or, as stated above, seasonally occupied fieldhouses. Of course, many have noted (e.g., Wilcox 1978; Crown 1985; Pilles 1978) that other functional interpretations are possible, but again, determination of these must await more comprehensive morphological and contextual analyses.

Multiroom structures parallel the morphological diversity seen in other small site types, but in contrast they appear to be associated with a greater sphere of activities. Considerably less frequent than other small sites, these structures exhibit construction and site assemblage characteristics similar to single-room structures, especially in regard to wall foundations. Differences, however, appear in the addition of rooms, complexity of entryways, presence of a variety of extramural features, and the development of enclosed spaces adjacent to the structure itself. The most distinctive of the multiroom structures incorporates a relatively large main chamber, usually circular, with two arc-shaped wing walls that curve in towards one another and create a vestibule or antechamber. Both rooms have axially placed entryways, sometimes with a step up into the main chamber, opening to the east-southeast. In general, the walls of the main chamber appear more substantial, at times at least 1 m in height, while those of the vestibule are more like footings for brush windbreaks. Although basically similar to single-room sites in the lack of external features and limited artifact assemblages, these structures may be roughly akin to alcove houses. Defined by Colton (1920:298-301) and Hargrave (1933:37-43), alcove houses originated as semisubterranean structures containing a primary living area with an attached chamber of somewhat smaller proportions (see G. Vivian 1956 for excavated example). Varia-

tions included moderately deep, wooden-lined pit structures to houses constructed on artificial platforms. While this comparison does imply a morphological similarity and suggests some form of architectural continuity in the Flagstaff region, one can only assume that these structures were used at Wupatki in the same way as those from other areas of the region.

Another type of multiroom structure consists of adjoining rectangular rooms, set in a linear fashion, which frequently exhibit numerous internal features, external activity areas, and moderate amounts of household trash. While once again following the general construction methods outlined above, these structures often reveal architectural details (e.g., rooms lacking doorways) indicative of both occupational and storage functions. The combination of seasonal use and granary facilities in a single structure represents an obvious solution to problems of widely spaced field systems requiring lengthy travel. As Wilcox has stated, "Storeroom-field houses probably spread because they helped societies that were in the process of intensifying their agricultural production to solve several organizational problems" (1978:28). Even though a number of other functional interpretations may be advanced--including particularly advantageous storage locations, multiple site functions, or defense of stored grains--there seems little doubt that the storeroom fieldhouse "extend(s) a central pueblo's effective range of agricultural exploitation" (Wilcox 1978:28).

Although represented by only a few examples, farmsteads reflect a problematic site type wherein characteristics of both small and large sites are evident. Morphologically, these sites contain multiroom structures, often with complex entryways and internal features, a variety of well-defined external activity areas, numerous subsurface structures, extensive household trash, and more than likely an enclosing wall or plaza. An especially good example of a farmstead, located on the north rim of Antelope Wash, displays all of the above components as well as an enclosing wall. From a distance this site probably presented a squat, unimposing profile where the main structure and adjacent work areas were obscured by a brush wall. Upon entering the farmstead through an offset gateway, one would have seen a variety of work areas, some trash, a few ramada-like brush shelters, storage facilities, and a primary building, all of which tend to indicate functional complexity and year-round habitation. Wilcox (1978:26) has perceptively argued that sites containing this assemblage of characteristics may reflect alternative small-group strategies of a familial rather than communal nature. Therefore, farmsteads differ from other small site types in their length of occupation, diverse range of activities conducted, and organizational structure, but still remain as functioning components of the agricultural system.

What remains is to try and understand the overall functional role of field structures in the agricultural and settlement landscape. As more intensive field studies have been completed, producing a much more comprehensive view of prehistoric settlement and land use, the question of the relationship between small and large sites has emerged. One of the earliest discussions of this problem was advanced by H. S. and M. R. F. Colton (1918). Based upon examinations conducted throughout the Flagstaff area, they identified a series of small site types that appeared to be related to dispersed farming techniques and concluded, "It is probable that a number of these houses served as summer shelters only, therefore we have little reason to believe that they were all occupied at the same time"

(1918:124). The Coltons went on to imply that this pattern of seasonal use, in conjunction with the requirements of shifting cultivation, would result in a multitude of fieldhouses, many of which would be abandoned after exhausting the adjacent fields. Haury (1956) modified this position by postulating that the use of fieldhouses developed in response to nucleation of what had previously been dispersed populations, and in doing so he precluded the possibility of field structures in less complex societies. Moore (1975) offered a somewhat different explanation by noting that nonaggregated groups also employed seasonal structures when utilizing fields located away from their base camp, with the relevant variable here being one of distance rather than organizational format. In an attempt to resolve these differing views, Wilcox (1978:27-28) presented a model of shifting cultivation that incorporates other aspects of subsistence (e.g., gathering strategies) while indicating a correlation between fieldhouses and an increased reliance upon soil and water conservation facilities. Although this model certainly reflects some of the patterns seen at Wupatki, it only partially explains the spatial and technological variability of field systems within the agricultural landscape. Therefore, the following sections reconstruct the agricultural landscape in both a descriptive and analytical fashion so that a more sufficient model of agrarian ecology may be developed.

The Agricultural Landscape: Geography and Ecology

Any examination of agricultural systems must, by nature, be concerned with the role the environment played in technological decision-making, field location, and choice of cultigens. The multiplicity of decisions that go into this process ultimately contribute to the relative success or failure of a given system. As previously mentioned, though, delineating the appropriate environmental variables and identifying methods of measuring their relationship to the distribution of agricultural elements is inherently difficult. One approach to this problem is to narrowly define independent sets of variables--such as soils, vegetation zones, land classification units, and so forth--tabulate the distribution or proportion of agricultural elements in relation to those variables, and then decide which attributes of each variable appear most significant in the agricultural decision-making process. Clearly, this is easier said than done. While many environmental variables may be investigated through simple frequency distributions, some require more sophisticated evaluation, including chemical and physical analyses. These latter techniques, exemplified in studies concentrating on specific fields (e.g., Berlin et al. 1977; Phil Geib, personal communication), certainly facilitate a thorough understanding of field ecology and decision-making. Unfortunately, these same studies lack the broad geographical perspective necessary for understanding technological and ecological variability in the farming landscape as a whole. Responding to this dilemma, this section examines the geographical extent and characteristics of the agricultural landscape, and then briefly analyses a variety of ecological variables as they relate to agricultural land use.

Uplands and Lowlands: The Geographical Context

Broadly speaking, two major physiographic zones characterized by

specific topography, geology, hydrology, vegetation, and climate--are present within the Monument boundaries (Fig. 4.15). The upland or plateau zone comprises the western portion of the Monument and extends from the base of the Antelope Hills on the west to the Doney Cliffs escarpment on the east. Exhibiting two distinct areas, the uplands lie at elevations above 5,000 feet, gradually slope towards the east and the Little Colorado River, receive fairly consistent moisture, and are covered by a combination of open pinon-juniper woodlands and various grasses. The westernmost portion of the uplands reflects a complex topography composed of prominent basalt mesas, a single large sink, basin-like limestone troughs or grabens, open park lands, and moderately dissected canyons. Quite simply, this area contains considerable relief and a wide array of microenvironments. In contrast, the eastern segment of the uplands is dominated by Antelope Prairie, an expansive flat plain that is drained by the headwaters of Citadel Wash and the deep, meandering gash of Antelope Wash.

Decidedly different in character, the lowlands zone is structurally a part of the Little Colorado River Valley. Physiographically this area appears to be a huge, bowl-like basin bounded on the west and south by the Doney Cliffs and numerous basalt flows extending from the uplands. Within the basin, numerous small watercourses drain east towards the river with small residual limestone/sandstone ridges, round-top hills littered with river gravels, and moderate-sized dunes in between. Typically, the basin exhibits low rainfall and intense summer temperatures, which produce a sparse vegetation consisting of various cold desert shrub associations and a small contingent of reptilian, avian, and mammalian fauna (Bateman 1976). In summary, then, the upland and lowland zones represent two distinct environments that, although geographically juxtaposed and in part bridged by the Sunset Crater ash fall, are separated by significant geological and ecological barriers.

Utilizing the aforementioned geographical framework, Figures 4.16 and 4.17 depict the tabulated frequency of agricultural features and single-room field structures per quarter section throughout the Monument. In addition, Figure 4.18 displays the actual location of multiroom structures that may have been related to agricultural activities. Overall, the three figures exhibit similar distributional profiles, with roughly three-quarters of all agricultural features (73%), single-room field structures (72%), and multiroom field structures (83%) located in the upland zone. A more detailed comparison of the distributions, however, reveals some differences in the spatial location and density of field components. Notably, agricultural elements appear to cluster in four areas of the Monument, while single-room field structures tend to have a more uniform distribution, with the only concentrations situated in the western portion of the uplands and surrounding Wupatki Pueblo. Multiroom field structures reflect yet another distributional pattern, wherein the western portion of the uplands, an area bordering Doney Cliffs and Antelope Wash, and the vicinity of Wupatki Pueblo contain larger frequencies than the rest of the Monument. What this variation suggests is that the apparent dichotomy between upland and lowland land-use patterns, while significant in broad terms, requires further examination.

In the western portion of the uplands, prehistoric fields tend to be small to medium in size, generally associated with field structures, and situated either individually or in small clusters. Although most of the field types previously discussed are present in the

FIGURE 4.15. Geographical Placenames

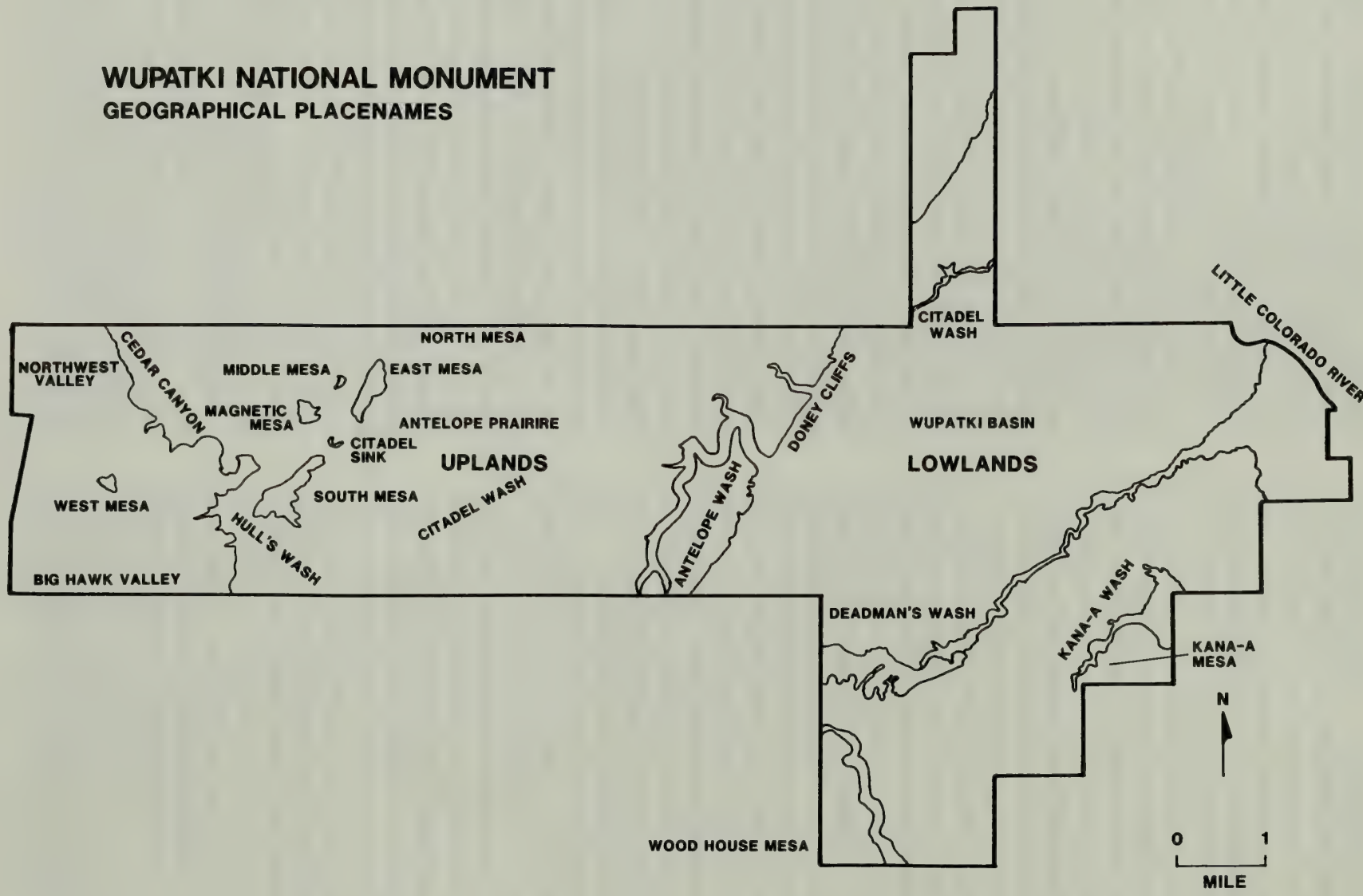


FIGURE 4.16. Frequency Distribution-Agricutural Features

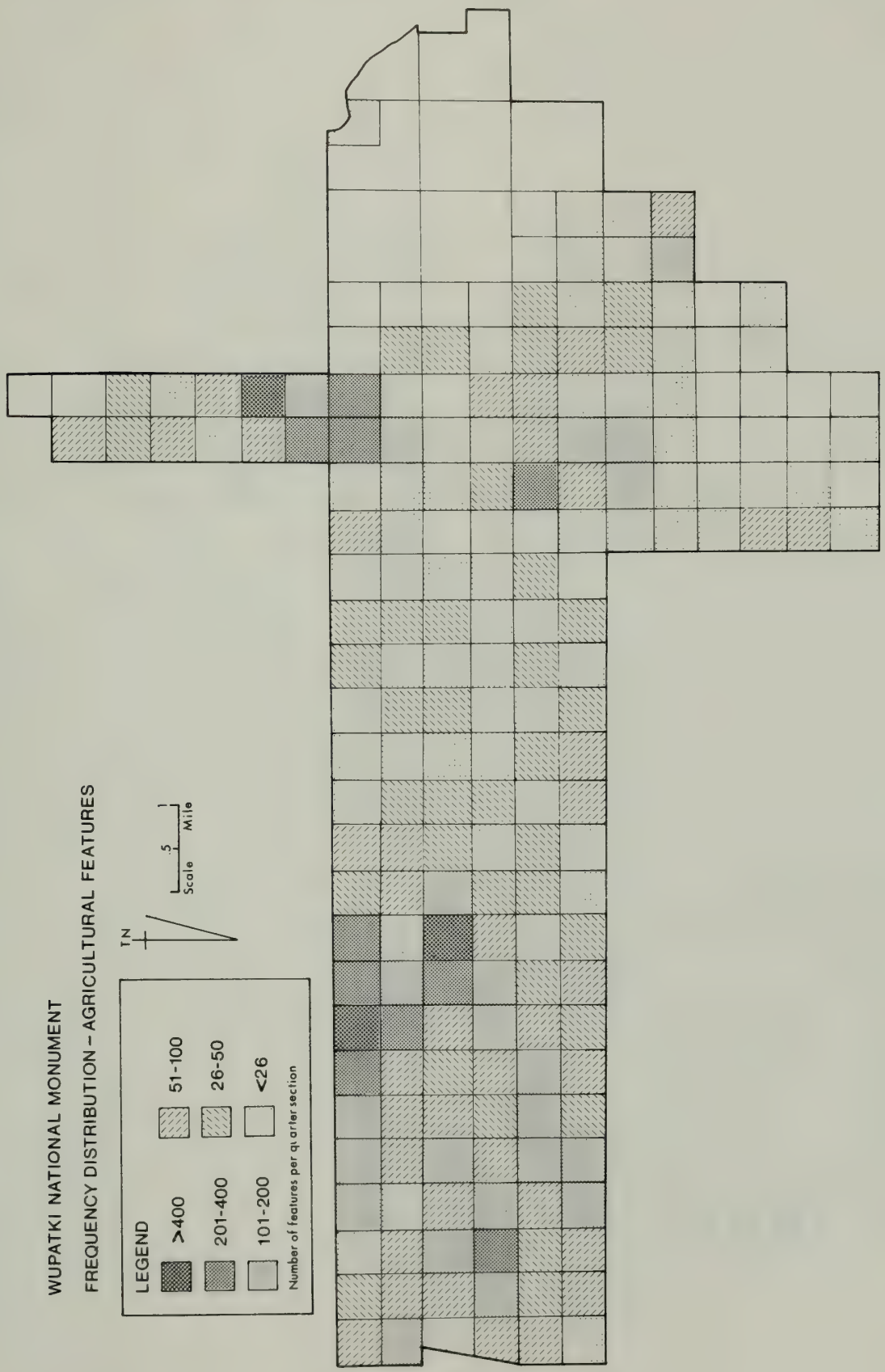


FIG. 4.16

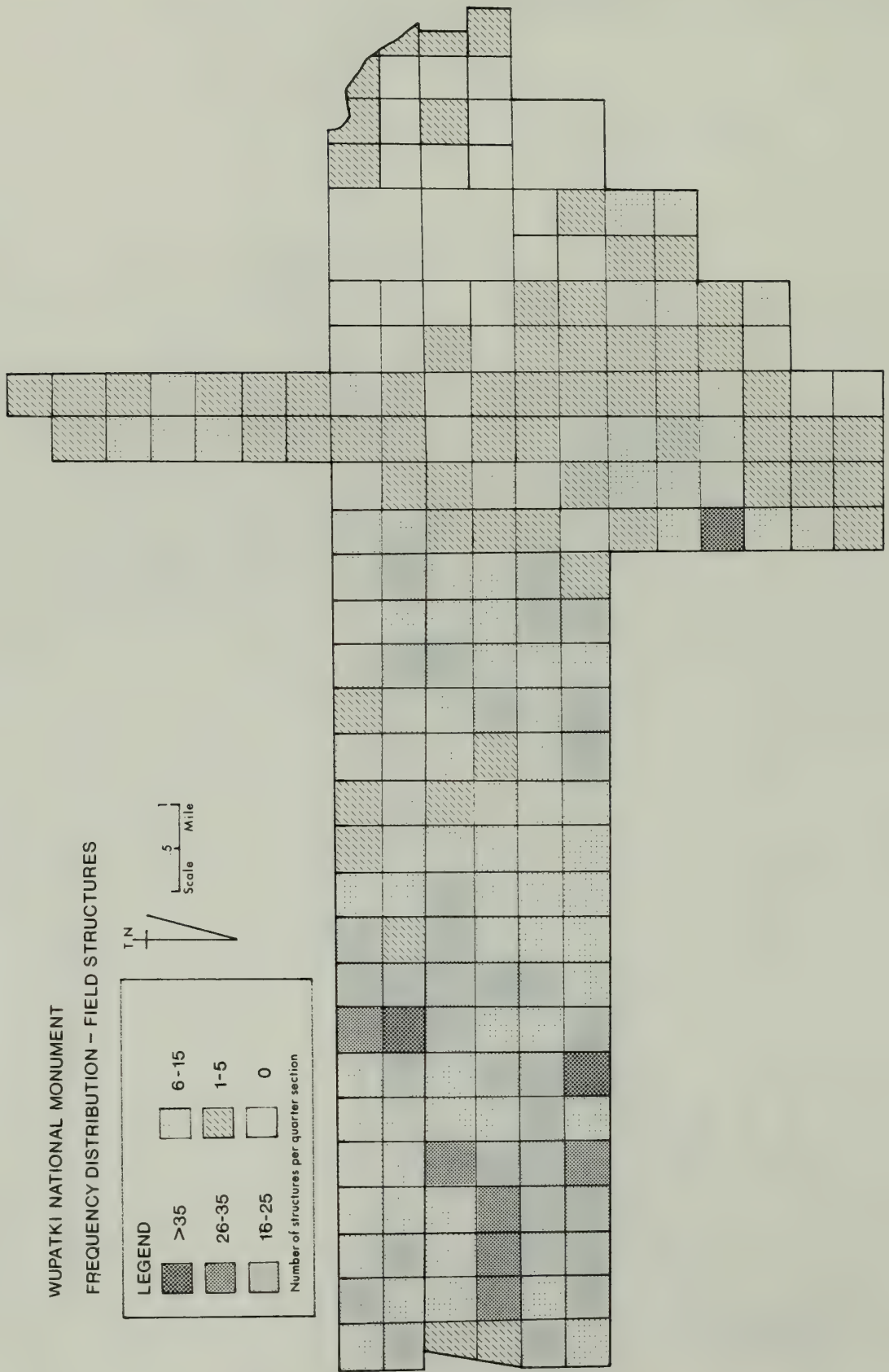
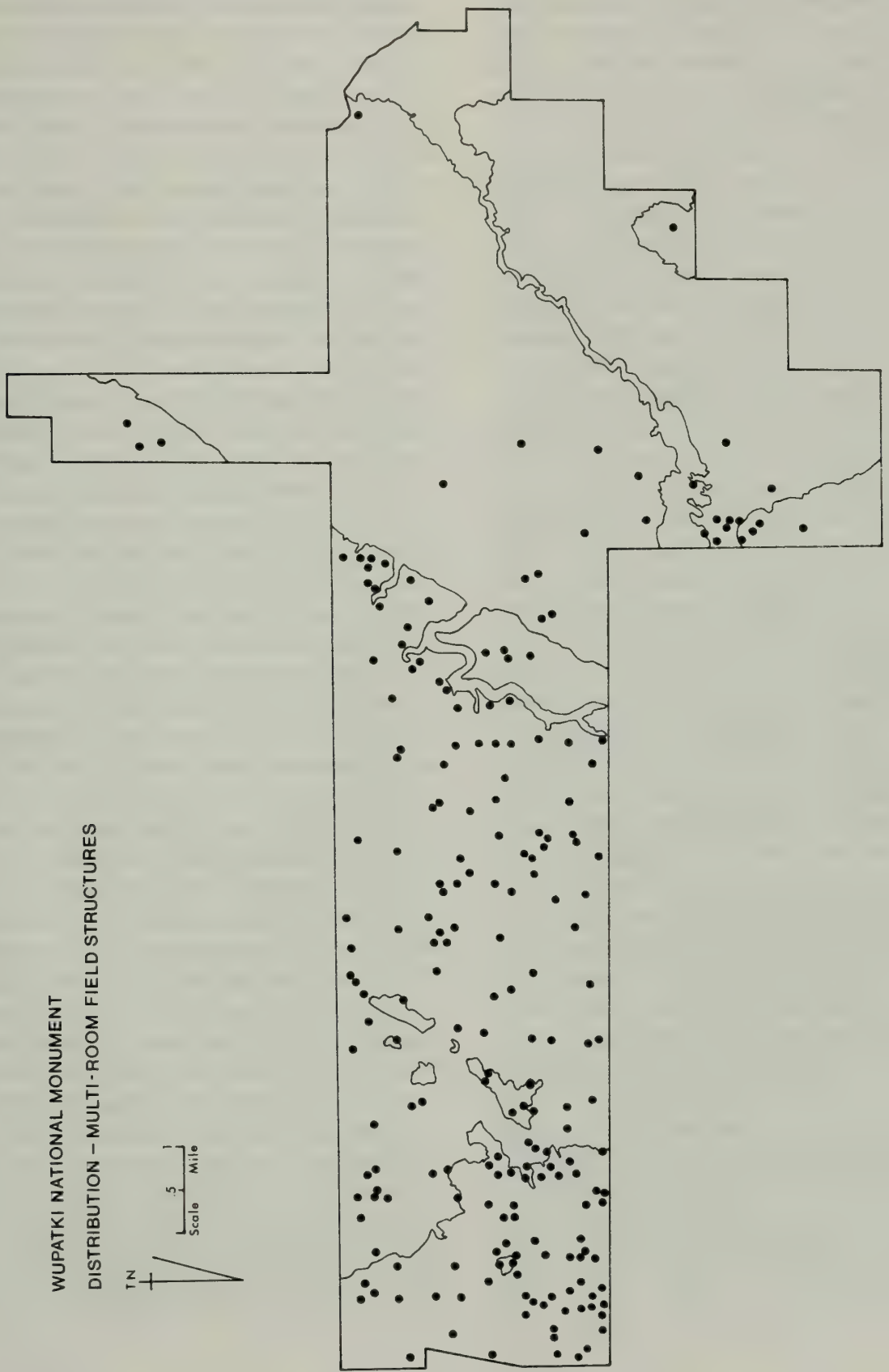


FIGURE 4.17. Frequency Distribution-Field Structures

FIGURE 4.18. Distribution-Multiroom Field Structures



predominate, with rock pile pile fields especially prevalent in the area surrounding Big Hawk Valley. Predictably, almost all of these fields were situated on top of and along the margin of mesas or following the contour of south-facing slopes, the exception being a few composite and terrace fields designed to accommodate more complex physical environments. While the overall spatial distribution of fields appears fairly uniform, there are portions of the landscape that exhibit what can only be termed intensive utilization. In particular, the area west of Cedar Canyon, the northern and eastern margin of Big Hawk Valley, Hull's Wash, and the Citadel District all reflect considerable agricultural activity unmistakably associated with long-term settlement.

Situated west of Cedar Canyon and north of West Mesa is a broad area, herein referred to as the Northwest Valley, composed of a centrally located basin surrounded by encircling mesas and low hills. A single drainage, entering the basin from the southwest, appears to sink into the deep, cinder-covered alluvium. Following the pattern noted earlier, most of the fields in the valley (N = 42) are small, simple or bordered types, often scattered individually across the landscape. Moderate clusters of fields, however, do occur on the limestone mesa bordering Cedar Canyon, along the north slope of West Mesa, and in the southwest corner of the valley running upslope from the drainage. In many cases these fields are larger, more technologically complex (with both terrace and composite fields present), and directly associated with village sites. The specific location of fields in the valley, going from most to least frequent, includes flat limestone mesa tops, the edge of mesas and down along their slopes, areas adjacent to ephemeral washes, or open grasslands.

South of the Northwest Valley, the environs of Big Hawk Valley present a somewhat different type of environment. Here the landscape is open, gradually slopes eastward, and exhibits few if any visual or physiographic obstructions. Apart from small, elevated areas to the west and a single basalt mesa along the northern margin, the valley contains little topographic variation and no apparent drainage systems. Although field size, type, and complexity mirror those seen in the Northwest Valley, that is where the similarity ends. Rather than the widespread distribution to the north, virtually all of the fields (N = 23) in and around Big Hawk Valley are clustered on primarily south-facing slopes of medium gradient. The only exception to this pattern may be seen in the northeastern corner of the valley just south of West Mesa, where rock pile, simple, and bordered fields appear to be evenly spaced. Somewhat perplexing, given the frequency of both single-room and multiroom structures, is the marked lack of identifiable fields throughout most of Big Hawk Valley. Whether this indicates poor environmental conditions, selection for habitation rather than agricultural land use, or the utilization of agricultural technologies requiring little modification of the landscape remains to be answered.

Hull's Wash is situated at the boundary between the basin/mesa relief and Antelope Prairie. Physiographically, the head of the wash drains the eastern edge of Big Hawk Valley, while to the north, South Mesa provides an additional, albeit small, catchment. Although similar to Big Hawk Valley in terms of field frequency (N = 24), the wash proportionately contains a greater number of rock pile and simple fields. These fields are uniformly small, often associated with multiple field structures, and generally close to bordered fields.

The final geographical component of the western uplands is the Citadel District, a moderately sized area characterized by ancient basalt flows, canyons cut through the Kaibab limestone, and Citadel Sink. Elevated above the surrounding landscape, the volcanic mesas provided space for extensive settlement, ideal observation platforms, and to a lesser extent usable agricultural areas. It was, however, at the base of mesa slopes and on the cinder-covered plains below where most of the agricultural land use supporting the community occurred. Spread across an area extending from just east of Cedar Mesa to the southern slopes of North Mesa and then south to South Mesa, this portion of the system contains the highest frequency of fields (N = 47) within the Monument boundaries. Further, the size, typological variability, complexity, and density of these fields suggests an intensification of agricultural effort unparalleled by any other community in the region. To begin, field size ranges from relatively small, individual plots to combined field areas covering thousands of square meters. Similarly, the types of fields present include the entire spectrum of those discussed and exhibit pronounced geographical variation.

Requiring the least amount of technological investment, rock pile, simple, and bordered fields predominate on the flat plains east of Cedar Mesa and north of Middle Mesa. Despite their size, however, these fields represent relatively simple attempts at soil and water conservation. In contrast, the fields that utilized areas along the base of mesa slopes employed an array of technologies designed to control and/or experiment with specific microenvironments. Thus, small enclosed gardens and a plethora of complex field types lie clustered around the south end of Middle and Magnetic Mesa, the northern slopes of South Mesa, to the east of Citadel Pueblo, on the west side of East Mesa, and in a broad arc running along the east side of East Mesa north to the southern flank of North Mesa. In short, this land-use pattern indicates a sophisticated exploitation of the landscape wherein physiographic character, soil type, and hydrology influenced the adaptation of a given field technology.

Characterized by minimal physiographic diversity, the eastern portion of the upland zone (Antelope Prairie) reflects a very different agricultural land-use pattern from that seen to the west. By any measure, field frequency, size, technological variation, and complexity diminish as one moves west to east. In addition, identifiable field locations are limited to established drainages or the occasional playa-like water catchment. Overall, then, the prehistoric field systems dotting Antelope Prairie are less complex, and by inference, more easily understood than their counterparts further west. Problematically, though, the distribution of small to large sites, particularly across the southern portion of the prairie, may give clues to the location of field systems that were used for brief periods of time, failed to survive postdepositional erosion, or required minimal modifications to the landscape.

Citadel Wash, which begins just east of South Mesa, drains the northern prairie before dropping down into Wupatki Basin. Throughout its course, this wash is shallow, generally dry, and at times barely visible--conditions that are hardly conducive to agricultural land use. Therefore, it is somewhat surprising to note the existence of various types of fields, some of which are quite large in extent, following the wash as it drains eastward. A careful examination of these fields reveals two distinct patterns. At the far western end of the wash, a complex arrangement of rock pile and bordered fields appears to have been located to take

advantage of drainage from South Mesa. These fields (N = 32) and a number of modified water catchments may have been related to the Citadel community as are the fields located north of Middle Mesa. Just to the northeast and expanding out from the main wash, the land-use pattern abruptly changes to one focused on widely spaced simple fields (N = 11) aligned along slight drops in elevation. Presumably, these elevational contours channeled subsurface water towards Citadel Wash and therefore provided a fairly reliable catchment for agricultural use. In support of this argument, the distribution of small villages across the prairie also seems to follow the same pattern of elevational contours.

On the eastern edge of the uplands, Antelope Wash slices a deep north-south canyon through the Kaibab limestone. Entering the western side of the canyon are numerous side washes that drain a sizable segment of Antelope Prairie. Following the pattern established for Citadel Wash, small simple and bordered fields were located along each of the ephemeral drainages in an effort to capture what moisture was available. The frequency of these fields (N = 11), ranging from one to as many as five, may indicate that these drainages were somewhat limited in their agricultural potential. Regardless of this, however, the application of specific field technologies to locations of this sort certainly suggests a sophisticated understanding of local environmental conditions.

Finally, two additional upland areas, Woodhouse and Kana,a Mesa, are only partially contained within the boundaries of the Monument. Created by basalt flows, both mesas extend into Wupatki Basin and are covered with various grasses and sparse pinon-juniper woodlands. Although similar in environmental character, the two mesas reflect different land-use patterns. Woodhouse Mesa, with the Wupatki community located just below on its northern slopes, exhibits a dense concentration of small villages associated with other structures and fields (N = 6). All of the fields, with the exception of a terrace system overlooking Wupatki pueblo, are small, simple in configuration, and spatially integrated with the villages on top of the mesa. By comparison, Kana,a Mesa displays little long-term habitation but fairly substantial simple and bordered fields (N = 5) that may have been related to lowland villages to the west and southwest.

Agricultural use of the lowlands, while limited in comparison to upland areas, followed a predictable pattern wherein fields were located along major drainage systems, across the tops of narrow mesas, at the heads of small washes originating on gravel terraces, and more infrequently on the slopes of the Doney Cliffs. Within these systems, field size, type, and configuration vary considerably; no doubt they are remains of adaptations to specific physiographic, hydrographic, and edaphic conditions. What results is an agricultural system characterized by a series of clustered fields separated by large tracts of unused land. In addition, an environmental threshold based on low rainfall, extreme summer temperatures, and marginal soils appears to exist about two miles east of the cliff line. This threshold represents the maximum limit of agriculture in the Wupatki Basin.

Three areas within the lowlands may be examined in greater detail. Each area contains sizable fields, at times clustered together, in association with a variety of small sites or villages. Northeast of Wupatki Pueblo, between and just beyond the entrenched drainages of Deadman's and Doney Wash, is a relatively large area dominated by grass-covered gravel terraces that slope towards the east. In this area

agricultural fields (N=41) were located across open gravel terraces and along the cinder-covered slopes bordering the two major washes. Field sizes, somewhat difficult to measure given the clustering evident, range from fairly small to quite large, while field technologies include simple, bordered, and composite types. Virtually all of these fields were situated to control and conserve what was clearly a very limited water supply. However, rather than simply locating fields to catch as much water as possible, the prehistoric farmers appear to have been concerned with balancing adequate subsurface water with proper drainage and soils, illustrating once again the sophisticated nature of the agricultural systems. Another example of this approach may be seen just north of Doney Wash, where a series of simple and bordered fields (N=5) were positioned at critical points on top of a residual limestone mesa. Here, the fields are placed to accommodate small drainages that collect subsurface water from the mesa top, while at the same time ensuring that crops were not located in areas prone to pooling.

Paralleling the situation described above, the area bordering Citadel Wash exhibits concentrations of simple, bordered, and composite fields situated on limestone mesas or on the cinder slopes below. While the location of these fields is clearly related to a line of villages following the base of Doney Cliffs, the presence of a deep cinder mulch, well-drained gravelly loams, and an underlying limestone substrate may actually explain their ecology. Given the lack of yearly rainfall (discussed later in this section), all of these fields would have required careful placement and additional moisture at critical junctures of the agricultural cycle. Despite these limitations, many of the largest and most complex field systems within the Monument occur in this locale. Once again, this distribution suggests an exacting utilization of the landscape by adapting specific field elements and configurations to minute environmental variations.

North of Citadel Wash, along the sloping flanks of the Doney escarpment, is a small area dominated by a number of medium to large-sized villages surrounded by widespread fields. Primarily composed of simple and bordered types, with a few examples of large-scale terrace fields and bordered gardens, the agricultural landscape reflects a rather casual use of ephemeral drainages originating on Antelope Prairie to the west. By and large the fields are small, isolated, and associated with a variety of field structures. However, one farming location containing a bordered field and gardens varies from this pattern in its association with multiple small villages.

In summary, a comparison between upland and lowland field distributions produces the following results. Throughout the Monument, field frequencies generally decline from west to east, the highest concentrations located north and east of Citadel pueblo and along Citadel Wash. Exhibiting something of a reverse pattern, fields across the uplands tend to be small to moderate in size, while those in the lowlands are frequently quite large. This dichotomy, however, appears to be as much a function of specific physiographic locations as anything else. More clearly defined differences emerge in the variability of field type and physiographic location. While the uplands contain a wide range of intensive technologies adjusted to microenvironmental conditions, the lowlands exhibit fairly simple agricultural systems designed to manage extensive plots of land. Finally, the use of highly diverse physiographic settings is much more pronounced throughout the western uplands than in either Antelope

Prairie or Wupatki Basin. Overall, then, significant differences between the upland and lowland agricultural landscape indicate functional differentiation in land-use strategies, with the uplands being used intensively and the lowlands extensively. The following discussions, while very brief in nature, should help to clarify the ecological characteristics underlying these differences.

Land Classification Units

Eleven land classification units, defined as portions of the wider landscape exhibiting discrete physiographic characteristics, have been identified for Wupatki National Monument. Depicted in Figure 4.19., these units are variable in terms of their size, overall extent, and geographical location. In rough order of magnitude the defined units include open prairie, dissected sandstone, canyons, washes, mesa tops, alluvial basins, alluvial fans, slopes, escarpment, cinder cones, and outcrop ledges.

To understand the agricultural use of these units a simple technique tabulating the frequency of field elements in comparison to the distribution of individual classification units was developed. Based on this analysis, the vast majority of all agricultural elements (94.7%) were located on slopes (28.3%), washes (27.3%), mesa tops (19.8%), and open prairie (19.3%). The remainder were situated in canyons, areas of dissected sandstone, or alluvial basins. Not surprisingly, the Doney escarpment, alluvial fans adjacent to the Little Colorado River, and various outcrop ledges show no evidence of agricultural modification or use.

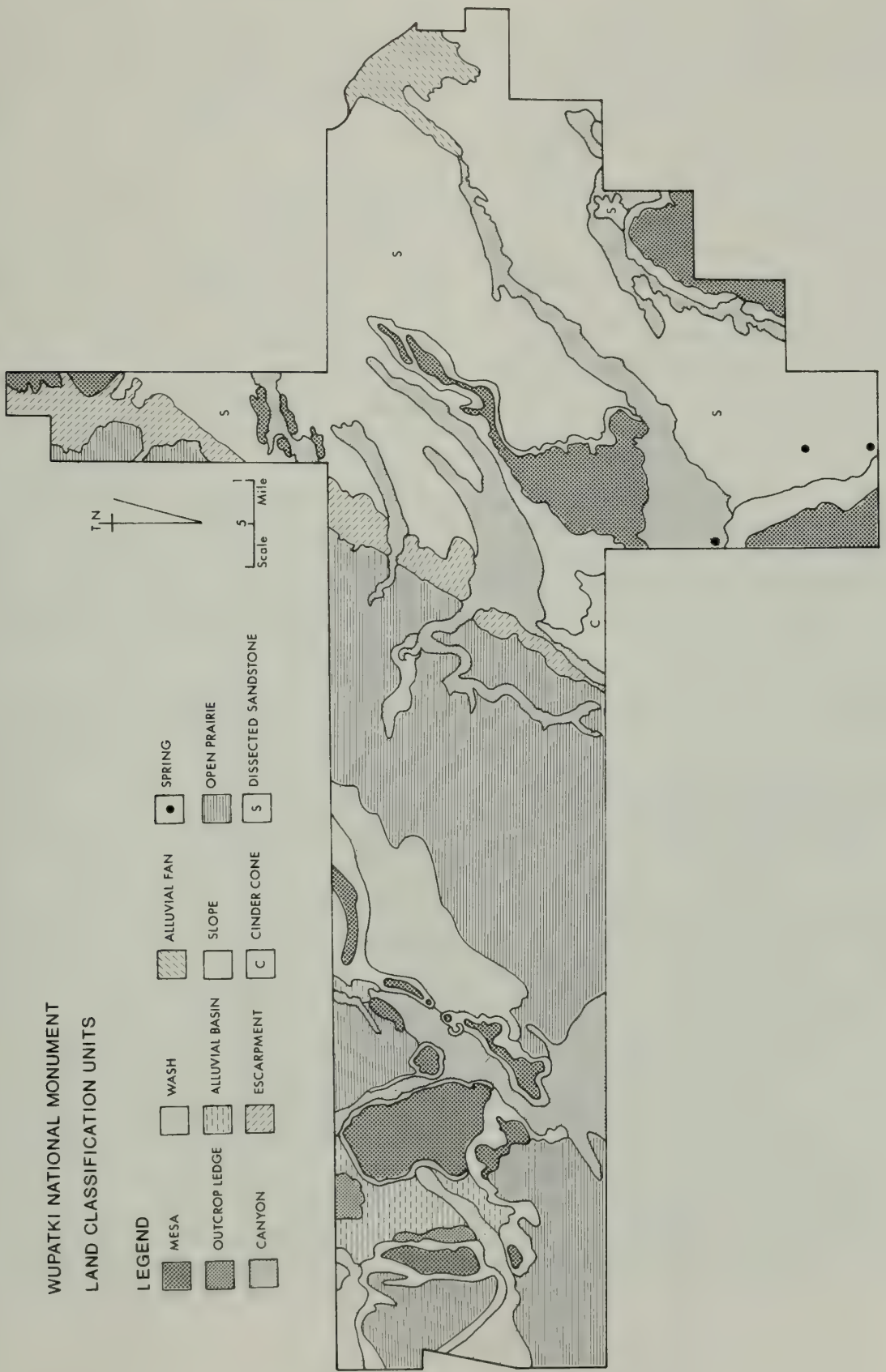
Interpreting this distribution, all four of the extensively used land class units appear to contain adequate soils, hydrographic characteristics, and advantageous geographical locations. In contrast, the other units present a range of problems that include highly variable soil depth, nutrient starvation, insufficient drainage, too much or too little water, and gradients beyond those that can be reasonably cultivated. As an interesting aside, neither the depth nor characteristics of the cinder/ash cover appear to have been a key factor in the physiographic selection of field sites. With the exception of the escarpment, adequate cinders blanket all of the land classification units, yet there is a striking difference in the utilization of these same units. Therefore, the initial choice of field areas may have been dictated by the general character of the landscape rather than a specific ecological attribute.

Another anomaly worth mentioning is the comparative lack of farming in alluvial basins. Given the inferred soil depth and apparent water availability this seems to contradict our understanding of prehistoric agriculture. While it is possible that large numbers of field elements and structures lie buried beneath deep soil profiles or that the agricultural techniques employed left only fragmentary remains, the explanation for this distribution may be found in the tendency for cold air to drain into physiographic low spots, thus compromising the length of growing season. If this is the case, then many areas that appear productive on the basis of soil and water characteristics may have proven unsatisfactory after only a short period of time (Eddy 1973).

Underlying Geological Features

Integrally related to the land classification units, the underlying geological features of Wupatki are limited to limestone, basalt, sandstone, and various shale deposits. In some cases these lithic forma-

FIGURE 4.19. Land Classification Units



tions are covered by deep alluvial soils to the extent that they no longer interact with surface vegetation. Once again, by tabulating the frequency of agricultural elements in relation to geological features a pattern was identified wherein those areas typified by adequate soil cover, nutrient base, drainage, and physiographic configuration were selected over those that exhibited shallow soil profiles, impermeable clay lenses, or unconsolidated lithic materials. The results of this distributional analysis indicate that 43.4% of the field elements were situated over limestone, 38.7% over deep alluvium, 9.8% over sandstone, and only 7.6% in relation to basalt outcrops with little soil cover. Predictably, less than 1% of all agricultural elements were located in association with shales or clay beds, this reflecting the damaging effects of too much water upon root systems. As with the land classification units, the majority of field elements (82.1%) were placed to take advantage of a fairly limited set of conditions.

Soil Zones

Table 4.2 illustrates the types and primary characteristics of soils throughout Wupatki National Monument. The distribution of these soil types, based upon an earlier soil survey than that discussed in Chapter 3, is illustrated in Figure 4.20. Clearly, the edaphic characteristics displayed in both the table and map indicate a highly varied soil structure, and they might suggest that prehistoric farmers encountered some difficulty in deciding which soils were most desirable. Instead, the tabulated distributions for the 21 soil types reflects a substantive pattern based on three distinct groups of soils. Each of the groups contains a collection of soil types that tend to replicate one another in both their relative characteristics and specific attributes. Thus, selection of soils for agricultural use may have been dictated by a combination of attributes rather than any single component.

Group 1 soils, composed of types 3B, IA, and 3E, are exclusively located in the upland zone. All three consist of well-aerated gravelly loams containing variable amounts of basalt, limestone, and calcareous sandstone. Consistent with the geological observations above, these soils tend to lie over limestone bedrock on gentle slopes of less than 5%, this leading to excellent drainage and permeability. The soil profile includes overall depths ranging from around 7 inches to over 39 inches, with a rooting depth of 24 to 36 inches and a variable cinder cover. The tabulated frequencies for Group 1 soils were 3B (24.8%), 1A (19.7%), and 3E (11.6%), resulting in a combined total of 56.1%. Therefore, over half the agricultural elements located within the boundaries of the Monument were situated on Group 1 soils.

The second group of soils (1B, 4E, 4H, and 3A) exhibits greater variation in geographical distribution and edaphic characteristics. Most of these soils are mixed, with various combinations of stony, gravelly, and cindery loams located on slopes of 3 to 15%. While the geological substrate varies, the drainage characteristics appear to be good to excellent throughout. Significantly, Group 2 soils follow a similar profile to that seen in Group 1, with an overall depth of up to 90 inches, rooting depths greater than 30 inches, and cinder covers of 3 to 9 inches. In combination, the four soil types in this group account for a sizable percentage (30.1%) of the field elements within the Monument, although individually each contains 8% or less of the total distribution.

The final group of soil types (2H, 3C, 2C, 5E, and 5C) incorporates only 12.9% of the tabulated field element frequencies.

TABLE 4.2. Soil Types and Characteristics

TYPE	COMPOSITION	SUBS	PHYS	DRAIN	OD	MCD	RD
1A	Gravel loam of basalt & cinder	Basalt	0-5% sl Gentle fans & plains on basalt mesas 5200-5700′	Good with md. perm.	39+	8	24-36
1B	Stony loam of basalt, cinder, & limestone	Basalt flows	5-15%+ sl Gentle to strongly sl mesas/plains 5200-5500′	Good with md. perm.	30+	3	30+
1E	Fine to medium cinder gravel	Basalt mesas & limestone cliffs	0-50% sl Dunes with erosion Var. elev.	Rapidly perm.	20-60	-	24-30
1F	Coarse Loamy sand of cinder & basalt	Cinder	8-40% sl Doney Mt. Var. e.ev.	Good with mod. to rapid perm.	65-80	1-7	60 36
1H	Very gravelly cindery loam of basalt & cinders	-----	3-5% sl 4800-4900′ rapid perm.	Good with mod. to	90	9	30-40
1J	Very gravelly loam of pumice & cinder	Pumice	3-8% sl Old fans or beds of pumice 4900-5000′	Good with mod to rapid perm.	45-60	3	20-24
2A	Shallow cindery loam of sandstone & cinder	Sandstone & shale	0-5% sl Mesas % plains 5400′	Good with md. perm.	11-18	2-3	8-9+
2C	Very shallow gravelly loam of decomposed sandstone	Sandstone	0-3% sl Flat slopes, fans, & plains <5000′plains	Mod. perm.	4-7	-	4-7
2H	Very cindery loam in sand-stone outcrop (mixed with 2C)	Sandstone	0-30% sl Level & gentle fans/ depressions <5000′	Poor	Var.	Var.	Var.
2J	Very cindery loam of sand-stone, shales, & cinders	Sandstone	0-5% sl Mesas & fans 4600-4900′	Good with mod. to rapid perm.	9-15	5-9	12-15

TABLE 4.2. (continued).

TYPE	COMPOSITION	SUBS	PHYS	DRAIN	OD	MCD	RD
3A	Shallow gravelly loam of limestone, clacareous sandstone, & cinder	Limestone	0-3% sl Mesas & plains 5300-5400'	Good with mod. perm.	7-12	2-3	8-12
3B	Gravelly loam in limestone outcrop	Limestone	0-3% sl Plains & slight	Poor	Var.	Var.	Var.
3C	Cindery loam in limestone outcrop	Limestone	0-3% sl Gentle slopes & plains >5000'	Poor	3-5	3-5	3-5
3E	Gravelly loam limestone rock	Limestone	3-15% sl Steep slopes & scarps in canyons >5000'	Good	Var.	Var.	Var.
4E	Gravelly loam alluvium of basalt, limestone, sandstone & cinder	Sandstone	0-3% sl Plains <5000'	Good with mod. to rapid perm.	48-80	4-8	24-40
4F	Loam alluvium of sandstones, shales, basalt, & limestone (no cinder)	Floodplain	0-3% sl <4500'	Variablem.	60-100	2-5	36-48
4H	Cindery loam alluvium of basalt, cinders, & limestone	Mixed sediments	0-3% sl Valley fills & fans 5100-5400'	Good with mod. per.	80-90	7-9	36-42
5B	Rough broken land primarly decomposed shales	Eroded sandstone	3-40% sl hummocky mesas, ledges & fans of Moenkopi Formation 4400-4500'	Poor to moderate.	Var.	Var.	Var.
5C	Limestone canyons & scarps	Limestone	15-60% sl Steep slopes Var. elev.	Good	Var.	Var.	Var.
5E	Sandstone & shale canyons/ scarps	Sandstone	15-60+% sl Steep slopes 4300-4800'	Good	Var.	Var.	Var.

TABLE 4.2. (concluded).

TYPE	COMPOSITION	SUBS	PHYS	DRAIN	OD	MCD	RD
RV	Riverwash of sands, gravels, & cobbles	Riverbed	-------	----	---	----	---

Compiled from Soil Survey and Range Site and Condition Inventory, Wupatki National Monument, Arizona. A Special Report (1971). U.S. Department of Agriculture. Research by R.G. Schurig, Soil Scientist.

KEY:

OD - Overall soil depth
MCD - Mixed cinder depth
RD - Rooting Depth

sl - slope
perm - permeability
md - moderate

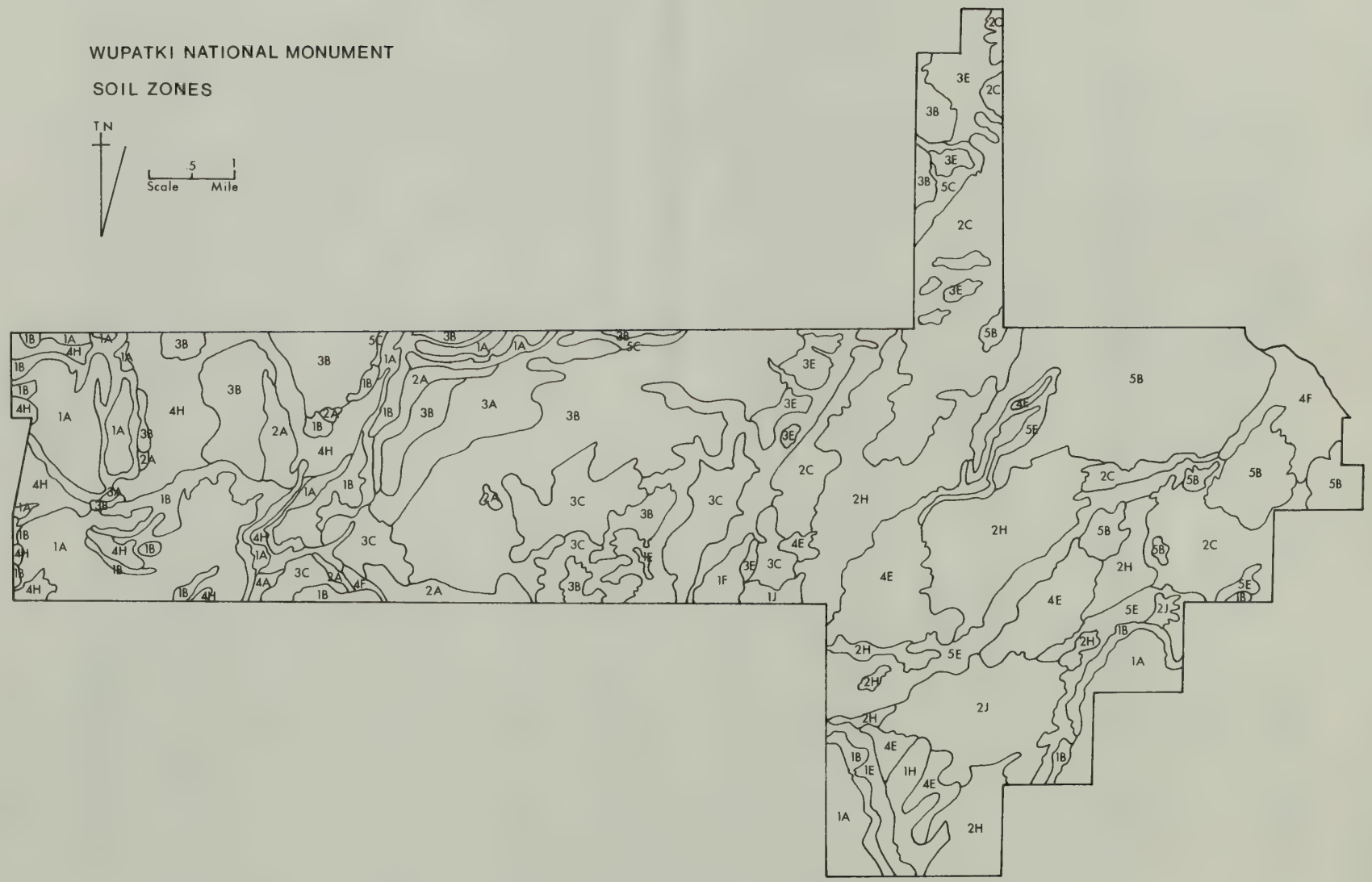
Scattered throughout the uplands and lowlands, these soils are cindery or gravelly in composition, generally overlie sandstone or limestone substrates, and cover a vast range of physiographic conditions. Despite this variability, the critical attributes appear to be shallow overall rooting and cinder depths. This factor, when coupled with poor drainage characteristics, probably made these soils unacceptable for all but the most determined of farmers. The remaining nine soil types were not used for agricultural purposes.

As illustrated in the distributions for the land classification units and underlying geology, there is a great deal of uniformity in the selection of soils, with almost 90% of the agricultural fields situated on only a third of the existing soil types. What this implies is that regardless of the overlying cinder/ash cover, long thought to be the determining factor in field selection (Colton 1960), specific types of soils were utilized in preference over others. While the presence of cinders, either as an ideal mulch cover of 3 to 9 inches or as a specifically designed field type (e.g. Berlin, Salas, and Geib 1990), certainly facilitated water and soil conservation, they were not inherently critical to the initial choice or continued maintenance of most agricultural fields at Wupatki.

Contemporary Vegetation

More fully discussed in Chapter 3, the contemporary vegetation of Wupatki National Monument includes a vast upland region of grasslands bordered by open pinon-juniper woodland and a relatively complex cold desert shrub biome dominated by various Atriplex associations in the lowlands. The biotic fertility of these vegetation zones reflects the interplay of climatic, physiographic, and edaphic conditions and therefore may give some clue to the comparative utility of the Monument for prehistoric agriculture. Problematically, though, the geographical extent of modern vegetation patterns fails to replicate those of the past and is perhaps the result of both changing climate and prehistoric through historic land use (Cinnamon 1988). Despite

FIGURE 4.20. Soil Zones



this caveat, the tabulated field element frequencies once again exhibit a consistent pattern. Just short of 70% of all field elements were discovered on contemporary grassland areas, while only 6% were identified in locales with substantial pinon-juniper cover, perhaps suggesting that a very slight rise in elevation may have been enough to discourage agricultural use.

A different pattern prevails as one goes from the uplands to lowlands. Here, substantially fewer agricultural elements (approximately 25%) were found associated with the five atriplex communities spread throughout the basin. The geographical patterning of these elements, however, indicates that three of the Atriplex associations, all located north of Deadman's Wash and containing a somewhat higher biomass, were invariably selected for agricultural exploitation. Given the limitations upon lowland agriculture already discussed, it is not surprising that those areas not used for agriculture exhibit sparse vegetative communities, few usable soils, drainage problems, and a decided lack of moisture. In a very simplistic way, then, this distribution implies that the overall biotic potential (as measured by the density of plants in a given area) compares favorably with the distribution of prehistoric agricultural elements.

Precipitation and Hydrology

The pattern of precipitation across the extent of Wupatki presents an intriguing problem. Basically, precipitation occurs sporadically throughout the year, with peaks during the late winter/early spring and mid- to late summer. The early storms, which may continue for days at a time, are characterized by widespread soaking rains or light to moderate snowfalls. In contrast, the late summer cyclonic storms arise on an almost daily basis, drop torrential rains in fairly limited areas, and then dissipate rapidly. Geographically, the early rains often extend throughout the Monument, thereby providing the major source of water to surface and subsurface aquifers alike, but the summer storms appear to follow a predictable pattern that runs southwest to northeast across Antelope Prairie. Rarely do these summer storms range far enough eastward to provide moisture for the basin area or the Little Colorado River Valley. Consequently, the hydrology of Wupatki National Monument displays numerous patterns dependent upon overall levels of precipitation, physiographic and geological character, and elevation.

In the upland area, particularly west of Antelope Prairie, precipitation levels reach a maximum of 11 to 16 inches per year. This level, and its identified periodicity, would have ensured adequate moisture for agricultural purposes and also recharged aquifers leading into natural reservoirs carved into the limestone bedrock. On the open prairie just slightly to the east, however, the annual rainfall dramatically decreases to around 6 to 10 inches, making agriculture considerably more difficult outside of established drainages. Further east and down into the lowlands, yearly rainfall dips below 6 inches per year, seemingly making the entire area incapable of sustaining nonirrigation agriculture. Besides a handful of dissected washes and a few perennial springs, there is virtually no surface water present in the basin until reaching the Little Colorado River itself.

Given the rather stark and arid picture portrayed above, it was surprising to learn that a large percentage of all agricultural elements (72.1%) are located in areas receiving less than 10 inches of precipitation

per annum. The explanation for this apparent incongruity lies in the adaptation of agricultural technologies to carefully chosen microenvironments. In this regard, the presence of cinders and ash, already questioned as a determining factor in field selection, may have been significant. However, as shown in the geographical discussion, most of the fields placed in drier areas were positioned to take advantage of subsurface drainage systems and particularly good soils. This pattern also helps to explain the difference in field density between the western uplands and the rest of the Monument. Supported by sufficient moisture, fields in the western uplands could be located according to the most advantageous physiographic and edaphic settings, while those located in other areas were tightly restricted to hydrological conditions. Thus, the western uplands reflects a more uniform or homogenous use of the landscape in comparison to the geographically limited agriculture characteristic of Antelope Prairie and the lowlands.

Temperature and Wind

Overall, little can be said concerning either temperature or wind as factors affecting agricultural fields. Temperatures within the monument range from around freezing in the winter to well into the 90s during the hottest part of the summer. What this translates into is a growing season that exceeds the 120 day frost-free limit normally attributed to maize agriculture. As noted above, though, there may be a number of areas within the Monument, such as portions of the Northwest Valley or at the base of the Doney escarpment, that frequently experience cold air drainage. If prolonged, this cold air can limit the growing season and potentially damage both seedlings and mature plants. This may be yet another reason for the tendency to plant at the edge of mesa tops rather than at the bottom of slopes in certain areas of the Monument.

Wind, a potent force during the late spring months, can destroy new seedlings by shredding the outer, protective layers of the plant. Further, winds often contribute to the overall aridity by drying out soils, catchments, and intermittent washes. To combat these effects, the farmers of Wupatki consciously positioned many fields behind slight rises or hillocks. In addition, the use of windbreaks for both individual and collective plant protection was essential. The presence of thousands of rock alignments, aligned in a northwest-southeast manner to protect against the prevailing winds, testifies to the damaging effects of wind.

Agricultural Decision Making and Ecology: The Microlandscape

By now it should be apparent that the process of agricultural decision-making combined the application of specific field technologies with the selection of appropriate environmental features. These features included physiographic location, soil and water characteristics, vegetative cover, sufficient frost-free days, wind protection, and the presence or absence of cinders. Further, the overall quality of these features varied depending upon whether a given field was located in the uplands or lowlands. Therefore, by examining the relationship between field elements and environmental variables a fairly clear pattern emerges, wherein agricultural land use can be described and to a certain extent explained.

By and large, the prehistoric inhabitants of Wupatki farmed upland slopes

of 3 to 15%, shallow washes, mesa tops, and the open prairie. In general, well-drained but relatively deep gravelly loams lying over limestone bedrock or deep alluvial profiles were preferred over soils exhibiting shallow depth, varied composition, and sandstone/basalt substrates. Although there are many questions concerning the comparability of ancient and contemporary vegetation, there appears to have been a pattern of locating fields in areas covered with grassland communities. Finally, most fields were situated in areas presently receiving less than 10 inches of annual rainfall, suggesting either climatic variation or accomplished water conservation techniques. While these characteristics reflect a dominant pattern of agricultural decision-making, there were regional variations that indicate additional agricultural strategies.

Returning to the geographical examination of the uplands, we saw how slight variations in precipitation resulted in significantly different patterns of land use. In the western uplands an annual rainfall of over 10 inches meant greater experimentation with both physiographic and edaphic settings. Scattered in an almost uniform way, the fields in this area employed a wider range of technical approaches than other areas of the Monument, and in no small way they replicate Hopi efforts to manage agricultural risk. Some of these fields, or more properly gardens, may have even been used to experiment with exotic cultigens such as Amaranthus or Chenopodium (Phil Geib, personal communication), while others were composted with household trash year after year. Following a considerably different strategy, those fields located on the open prairie hugged drainage gradients in an effort to extract waning water supplies. No doubt this pattern, the result of countless agricultural experiments utilizing both simple and bordered fields, led to fairly productive, albeit risky, agricultural locales.

Further strategies designed to manage exceptionally difficult environments may be seen throughout the lowlands. Although similar to the agricultural practices used on the prairie, lowland fields exhibit an even greater concern with soil and water conservation. Limited to the heads of drainages or on limestone mesa tops with consistent cinder cover, these fields employed a plethora of techniques, including terracing and bordered gardens, in an effort to extract what must have been a difficult crop. The riskiness of these ventures, however, should not be overstated in that extensive fields apparently supporting both Wupatki Pueblo and a line of smaller villages to the north were located in marginal environments.

In summary, the mosaic of agricultural fields spread across Wupatki represents a complex microlandscape that reflects an integrated set of agricultural strategies. These strategies were designed to manage slight variations in the environment by utilizing myriad technical and locational choices. Although many of these choices probably resulted in failure or limited success, it seems fairly evident that just as many succeeded, thus continuing a process of trial and error that began with initial settlement and subsistence efforts. Fundamentally, then, the prehistoric agricultural systems at Wupatki were developed to balance the vagaries of a dynamic environment by coupling intensive and extensive field technologies with a widespread, but exceptionally acute, use of the natural environment.

Evolution of the Agricultural Landscape

The following discussion will be, by necessity, quite brief since Chapter 2 investigates the evolution of prehistoric settlement within the Monument. Any attempt to examine the evolution of the agricultural landscape must first recognize the impressionistic quality of our information. As discussed in the introduction to this chapter, chronological and spatial relationships of a given field to adjacent settlements and/or structures is inherently difficult to reconstruct. Both require assumptions which at times represent a leap of faith rather than appropriate scientific method. Regardless of these misgivings, any effort to characterize even a general pattern of agricultural change will assist in developing hypotheses concerned with evolving social organization and human ecology.

In order to simplify this discussion, four chronological periods, combining many of the smaller temporal divisions of Downum and Sullivan, have been defined. Each period, extending from the earliest posteruptive occupation to final abandonment of the Wupatki area, represents an arbitrary slice of time based upon ceramic chronologies. Although this chronology has been considerably refined, however, its utility for examining the evolution of field systems remains quite limited.

Although the initial posteruptive settlement of the Wupatki region may have occurred almost immediately, it was 20 years or more before any substantial population moved into the area. Focused primarily in the western portion of the Monument, a few small groups apparently settled in areas roughly similar to those they had left. Tentatively, settlements emerged west of Cedar Canyon and on the eastern margin of Big Hawk Valley. While numerous rock pile, simple, and bordered fields lie in close proximity to these early pueblos, later settlements and field structures confuse the relationship. A somewhat clearer situation prevails on a knoll north of Big Hawk Valley, where a grouping of posteruptive fieldhouses are in close association with a number of bordered fields. These may represent some of the earliest fields within the Monument. Virtually all of them are small, follow a south-facing slope, and may have been used repeatedly through the years. In the lowlands to the east, a handful of small sites, possibly field structures, but more likely hunting and gathering procurement camps, represent the only other evidence for early settlement.

By the beginning of Period 2, running from approximately A.D. 1100 to 1150, there was a tremendous expansion in the number, variety, and complexity of settlements throughout the Wupatki region. Identified by H. S. Colton as a "prehistoric land rush" (1960), settlement and consequent land use was particularly intense in the areas of Big Hawk Valley, Hull's Wash, and the vicinity of Deadman's Wash. Contrary to the expected pattern of villages with adjacent fields, however, this period seems to be characterized by a widespread use of bordered fields and associated field structures in what may be termed outlying areas. Experimenting with virtually every possible agricultural niche, these fields were small to medium in size, often clustered together in areas like the head of Citadel Wash, and from the apparent distribution of field structures preoccupied in some sort of cyclical manner.

Period 3 communities, marked by a shift in both location and settlement size, apparently modified the earlier agricultural strategies to incorporate intensive technologies such as terracing, various types of

gardens, and composite field structures. In addition, the spatial characteristics of fields--located both in close proximity and at some distance from variably sized communities--suggest the development of infield/outfield systems designed to ameliorate agricultural risk and facilitate variety in the choice of cultigens. Examples of this type of system may be seen in the Citadel District, where combinations of intensively managed fields and gardens appear to be contemporaneous with simple and bordered fields covering extensive tracts of land, or along Citadel Wash below the Doney escarpment. The previous pattern of cyclical reuse noted for Period 2, while still prevalent in certain areas, seems to decline in overall extent. Just how to interpret this shift in the overall agricultural strategy is perplexing. While some may interpret agricultural intensification as an artifact of increasing stress and risk, an alternative view might explain the same phenomena as the result of communities locked in a competitive struggle for control of regional political and/or exchange systems. Theoretically, a confrontation such as this would require consistent experimentation in subsistence techniques in an effort to produce surpluses capable of sustaining large communities. Yet another interpretation would attempt to explain the patterned variability in agricultural land use as a physical manifestation of functional differentiation of communities within a larger regional framework or system. At this point in the analysis of Wupatki's agricultural systems, these hypotheses can only be suggested, not empirically or comparatively tested.

The final period of occupation, ending anywhere from the early to mid-1200s was characterized by a gradual contraction of the settlement landscape. While the large-scale communities of Citadel and Wupatki Pueblo continued to survive, numerous smaller villages in the western uplands and along the northern flank of the Doney escarpment were abandoned. Replacing the smaller communities was a fairly tight cluster of small villages located at the mouth of and along the rim of Antelope Wash. Once again, the emergence of these villages indicates a number of possibilities, including either the utilization of marginal areas during stressful times or the continued development of an integrated system concerned with controlling key access routes between the western plateau and montane environments. In support of this latter argument, none of the late Antelope Wash villages appears to have any agricultural fields close by, whereas the Citadel community continues to maintain a very complex agricultural system. Regardless of the nature of these settlements, the Wupatki region was apparently abandoned at some point during the A.D. 1200s the victim of either deteriorating climate or fundamental changes in regional organization.

What this brief sketch reveals is yet another level of agricultural organization and complexity not elucidated in the microlandscape analysis. Following what is essentially a frontier model of initial penetration, widespread experimentation/exploitation, intensification, and quiescence, the agricultural systems preserved at Wupatki suggest the possibility of cyclical reuse of field areas, the development of infield/outfield systems, and functional differentiation of communities on the basis of agricultural technologies. When linked with the multiple, but integrated, agricultural decision-making strategies outlined above, the farming system appears as both a subsistence effort and a reflection of basic social organization and settlement structure. Therefore, the mesolandscape, as exemplified in both the geographical and evolutionary discussions, exhibits a variety

of distinct areas or patterns that represent ecological selection, technological adaptation, and social control and/or allocation of the landscape--certainly a far cry from the image of simple farmers so often depicted in the archeological literature.

Conclusions

By now the morphological, functional, and geographical characteristics of the farming landscape preserved within the boundaries of Wupatki National Monument should be apparent. Rather than the "typical" agricultural strategy so often described in the literature of the prehistoric Southwest, the agricultural ecology of Wupatki reflects an amazing range of field size, type, configuration, specific technology, location, and spatial associations. All of these features suggest that Colton's hypothesis concerning the singular importance of the cinder/ash mulch of Sunset Crater, while certainly a relevant factor in agricultural decision-making, does not account for either the technological or geographical variation seen at Wupatki. In a similar way, the models developed to explain the distribution of field structures in relation to more permanent habitations also fail to accommodate the complexity of the agricultural system. In fact, given the patterned variability of this landscape, one can only conclude that some measure of political control, land allocation, and functional differentiation of settlement/land use areas was in operation. If correct, this observation would tend to support interpretations that favor a more rather than less integrated community structure and overall social organization. Testing this as well as other hypotheses, however, will require much additional work. Although this paper has attempted to carefully describe the archeological characteristics of the agricultural system, only a more analytical effort, heavily laden with comparative studies from both ethnographic and archeological sources, will eventually suffice.

Chapter 5

DESCRIPTION AND ANALYSIS OF PREHISTORIC SETTLEMENT PATTERNS AT WUPATKI NATIONAL MONUMENT

By Christian E. Downum
and Alan P. Sullivan, III

Introduction

This report presents an analysis of the prehistoric settlement patterns at Wupatki National Monument, based on prehistoric settlement and demographic data gathered since 1981 by an NPS archaeological inventory survey (hereafter referred to as the Wupatki Survey). Specific analytical goals are the identification of prehistoric site types and site functions; an estimate of prehistoric population size, density, and distribution in a spatial and temporal framework; the assessment of prehistoric economic, social, and political structure; and a consideration of the cultural identity of prehistoric populations. Further, this report identifies sites that may be crucial to future settlement pattern studies and recommends ways that potentially unfavorable impacts on these sites might be minimized. More specifically, the report includes: (1) a description of how the original survey data, recorded on field survey forms, were coded and converted into a computerized data file suitable for quantitative analysis; (2) the ceramic dating scheme employed in this analysis with a summary of the results of dating attempts; (3) basic data on the contents, form, distribution, and dates of all types of prehistoric sites; (4) a consideration of the spatial and temporal distributions of undecorated ceramic assemblages, first through the presentation of raw percentage values of four major wares

and then through a cluster analysis of the same wares; (5) a functional analysis of Wupatki sites, with suggestions for a four-part functional taxonomy; (6) an estimate of the prehistoric population of Wupatki National Monument during four temporal intervals spanning A.D. 1070 to A.D. 1275; (7) a summary and synthesis of preceding chapters; and (8) recommendations for the longterm management of prehistoric archaeological resources. An appendix in the microfiche pocket at the back of the book provides the computer-coded data on site attributes.

The Data Base

Because of the large number of archaeological sites (n = 2,668) recorded by the Wupatki Survey and the great amount of site information included on each field recording form, it was necessary to computerize the data base. This task was accomplished in several steps. First, the format of the field recording form was examined to determine which of the form's information categories might be converted to variables useful for analyses of site dates, architecture, artifacts, and features. When a list of such variables had been compiled, photocopies of the completed field recording forms for all archaeological sites were inspected and coded for data entry. Sites lacking a prehistoric component (n = 271) were excluded from further consideration. Data from the remaining sites (n = 2,397) were then entered onto a icrocomputer for analysis using the SPSS/PC+ statistical package (Norusis 1988).

From the original field survey forms for prehistoric sites, two data files were created: (1) a file containing information on each site's prehistoric architecture, artifacts, and features, and (2) a file containing information on each site's ceramic assemblage. The contents of the site data file are listed in Appendix II in the microfiche pocket at the back of the book.

Site-Level Information

Information on architecture, artifacts, and features were coded using the following variable definitions and formats.

Site Number

This is a four-digit numerical value corresponding to the Wupatki Survey (WS) site number assigned by the field recording crew, or, in four cases, arbitrary site numbers assigned by the authors: Wupatki Pueblo (NA 405) = WS 9991; Wukoki Pueblo (NA 203) = WS 9992; the Citadel (NA 355) = WS 9993; and Nalakihu (NA 358) = WS 9994. Coding decisions for these four sites were based on information provided by Colton (1946:49-50, 52-54, 55-63) and King (1949). All sites with individual components recorded under the same WS site number were recorded as a single site. For example, a site with seven structural components--WS 838A-G--was coded as a single case (in this example, as site number 838). The site number is listed in Appendix II as Variable 1 (VI).

UTM Coordinates

Each site's UTM Easting and Northing coordinates (Zone 12) were entered as six- and seven-digit numeric variables, respectively. UTM coordinates for all sites recorded by the survey were taken from values on the field recording forms. In nearly all cases, the UTM coordinates given on the forms were calculated for the site datum stake, usually located near the geographic

center of the site. For the four sites not recorded by the survey (Wupatki, Wukoki, the Citadel, and Nalakihu), coordinates were calculated from the geographic center of the photogrammetric plots of these sites as represented on the most recent USGS 7.5 minute topographic sheets. During coding and analysis, several site UTM coordinates were found to have been incorrectly calculated by the archaeological survey crews. These coordinates were recalculated from plots of site locations that had been recorded on USGS topographic sheets. In Appendix II, the site UTM Easting is listed as Variable 2 (V2), the UTM Northing as Variable 3 (V3).

Site Type

This is a single-digit numeric code that records a basic prehistoric site type category based on the preponderance of site features. The major site types are recognized, and are coded as follows: 0 = structures or enclosures present (see definitions below); 1 = artifacts scatter, no structures, enclosures, cists, or hearths present; 2 = agricultural field; 3 = reservoir; 4 = cists, hearths, or other small, upright slab features present in the absence of other architectural remains; 5 = building-stone quarry; 6 = shrine; 7 = rock art unassociated with other site type; 8 = burial area; and 9 = isolated artifact of special significance. Site type is listed in Appendix II as Variable 4 (V4).

Wall Height

This is a logical variable that records whether or not any surface structure at the site appears to have had an original wall height greater than or equal to one meter. The selection of the one-meter criterion is based on a study by Pilles (1978), who found this measure useful for distinguishing probable permanent habitation sites (walls one meter or more) from "field house sites," or seasonally occupied farming sites. A coding decision for this variable was based on published site descriptions or on all evidence from the site field recording form, including written comments speculating on original wall height and a consideration of the amount of fallen wall rubble indicated on the scale plan map.

Because the original wall heights of collapsed structures are notoriously difficult to gauge, this variable may not be particularly reliable. Errors are probably mostly of the "false negative" variety, however; i.e., positive identifications are probably correct, but many structures having an original wall height of one meter or more cannot now be identified as such. Thus, the variable is useful for identifying those sites most obviously possessing full wall-height structures, and any counts based on this variable have utility as minimum figures. Wall height is listed in Appendix II as Variable 5 (V5).

Number of Upper-Story Rooms

This variable is identical in its definition to the variable, "number of masonry rooms" (see Variable 10, below), except that it counts only those rooms identified as having been constructed above a ground-floor room. Number of upper-story rooms is listed in Appendix II as Variable 6 (V6).

PRESENCE/ABSENCE OF BEDROCK IN WALL.

This is a logical variable that records whether or not the main structure at the site is formed by the incorporation of bedrock into its walls. this variable makes no distinction between open-air sites and those sheltered by cliffs or other major land forms. The

variable appears in Appendix II as Variable 7 (V7).

Enclosure

This variable was created to account for those sites that do not have any above ground structures with a minimum interior dimension of at least two meters (see Variable 9, "number of structures," below), but nonetheless have small rock constructions that might legitimately be considered some form of shelter. Enclosure, therefore, is a logical variable (yes = 1, no = 0) that records whether or not a site that lacks structures with at least one room having an interior dimension of greater than two meters does include one or more structures that measure less than two meters. Enclosures are defined normally in precisely the same manner as larger structures, i.e., they must be enclosed on at least three sides. Thus, a simple L-shaped wall or an isolated linear wall does not qualify as an enclosure, while a small, three-walled construction or an arc-shaped, isolated wall is considered an enclosure. Note that a "yes" code for this variable can occur only for those sites where the number of structures (by the two-meter room criterion) is zero. This variable is listed in Appendix II as Variable 8 (V8).

Number of Structures

This variable, a two-digit numeric code, refers to the number of surface or sub-surface structures at the site. All coding decisions were made on the basis of published site descriptions, a scale plan map of the site, or descriptions of individual architectural features included on the field recording form. Because field criteria for computing the number of structures seemed to vary with individual survey crew members, the "number of structures" category on the site form was ignored in this analysis. There fore, structures are here defined as (1) any discrete masonry shelter space that is walled or otherwise enclosed on at least three sides by walls, or walls and bedrock, and has at least one room with a minimum internal dimension of not less than two meters, and (2) any evident pit structure or depression of the ground surface description or indicated on field recording forms as a pit structure, i.e., a possible pithouse, kiva, or other structure with the most substantial portion of its walls below the present ground surface.

It should be noted that the category of masonry structure may encompass such diverse architectural forms as one-, two-, or three- story pueblos; single-room, low-walled structures; shelters constructed around bedrock outcrops; and walled rock-shelters. The only common attribute of masonry structures are those listed above, i.e., that they appear to have been shelters incorporating at least one room measuring not less than two meters along its minimum internal dimension, and that they appear to have been constructed with the greater portion of their walls above ground. It should be noted further that pit structures are counted as discrete entities even if they appear to abut with or are enclosed by an above-ground masonry structure. Number of structures appears in Appendix II as Variable 9 (V9).

Number of Masonry Rooms

This variable is a two-digit numeric code that counts the number of ground-floor masonry rooms contained within the architectural units defined as structures. Note that this total may include individual rooms with a minimum internal dimension of less than two meters, so long as those rooms are part of a room block containing at least one

room with a minimum internal dimension equaling or exceeding two meters. In Appendix II, the number of masonry rooms is listed as Variable 10 (V10).

Number of Depressions

This variable is a two-digit numeric code that records the total number of evident pit structures or suspected structure depressions that appear to be potential pithouses, kivas, or other structures with the greater portion of their walls below the ground surface. It should be noted that the presence or absence of masonry was not used as a coding criterion, but only whether or not the structure appeared mostly subterranean. Thus, depressions may include masonry-lined pit structures. Number of depressions appears in Appendix II as Variable 11 (V11).

Construction Materials

The coding of construction materials was accomplished through the use of three variables: basalt, limestone, and sandstone. Each variable was measured in terms of its apparent contribution to the total amount of wall material used at the site, based on a published site description, or on information from the site field recording form. Thus, basalt, limestone, and sandstone (the only three stone types recorded on the Wupatki Survey as construction materials) were assigned one of the four following values: 0 = absent, 1 = primary building material, 2 = present in substantial quantities, and 3 = present, but rare. Any combination of these codes was possible for the three building materials considered, with the exception that only one of the three materials could be coded = 1, that is as the primary building material. Even if a primary material was identified, however, other materials could be coded as present in substantial quantities. Note that if two or more of the materials were coded as = 2 and no material was coded as a primary material (= 1), this meant that it was impossible for the coder to decide, from the available information, which material was the primary building material and that two or more materials were present in substantial quantities. In Appendix II, basalt is coded as Variable 12 (V12), limestone as Variable 13 (V13), and sandstone as Variable 14 (V14).

Extramural Wall Type

This variable refers to the type of stacked constructions at the site that are not part of a structure's enclosing walls. Codes are: 0 = no extramural stacked constructions; 1 = isolated, free-standing walls present (i.e., walls not attached to a structure or enclosure); 2 = "wing" or "plaza" walls present (i.e., stacked rock constructions that are attached to the enclosing walls of a structure or enclosure); and 3 = both freestanding and wing walls are present. Note that this variable does not include shepherds' benches, lambing pens, or other constructions identified in the field as dating to the historic Anglo or Navajo periods, nor does it include single-course rock alignments having a probable agricultural function. Extramural wall type is listed in Appendix II as Variable 15 (V15).

Artifact Frequency

This variable, taken directly from categories on the field recording forms, refers to the field estimate of the absolute frequency of artifacts present at the surface of the site. Codes are: 9 = no artifacts observed; 1 = 1 - 9 artifacts observed; 2 = 10 - 25; 3 = 26 - 100; 4 = 101 - 500; 5 = 501 - 1,000; and 6 = 1,000. In a small number

of cases (n = 29), this information had not been entered onto the field recording forms; in these instances, the variable was assigned a value of zero. On the basis of published site descriptions, all four of the sites with arbitrary WS numbers were given an artifact code = 6. Artifact frequency appears in Appendix II as Variable 16 (V16).

Rock Art

This is a logical variable that records the presence or absence of prehistoric rock art at or near the site, as reflected in the inclusion of maps or descriptions of rock art on the field recording form. The variable is coded regardless of site type, so that even those sites classified as Site Type = 7 (rock art unassociated with other site type) were coded as rock art = 1. Rock art is listed in Appendix II as Variable 17 (V17).

Ceramics

This is a logical variable that records the presence or absence of prehistoric ceramics at the site, as reported in the section of the form devoted to an enumeration of site artifacts. In three cases (sites WS 1385, WS 1443, and WS 1453), the presence or absence of ceramics was rendered ambiguous by the possibility of intrusive sherds originating from nearby Wupatki Pueblo, and the variable was coded = 9. The variable appears in Appendix II as Variable 18 (V18).

Debitage

This is a logical variable that records the presence or absence of un-retouched chipped stone flakes and non-flake debris. This variable does not include cores, hammerstones, or formal tools. Debitage is listed in Appendix II as Variable 19 (V19).

Flaked Tools

This is a logical variable that records the presence or absence of formal, retouched chipped stone artifacts such as scrapers, knives, drills, and projectile points. This variable does not include stone hoes or utilized flakes. The former are recorded as a separate variable (see below), while the latter are considered as debitage. Flaked tools are listed in Appendix II as Variable 20 (V20).

Ground Stone

This is a logical variable that records the presence or absence of ground stone tools or tool fragments. The category incorporates manos, metates, lap stones, abraders, shaft straighteners, "bath sponges" (Colton 1946a:290), etc., but it does not include basalt cylinders, which were recorded as a separate variable (see below). This variable appears in Appendix II as Variable 21 (V21).

Cores

This is a logical variable that records the presence or absence of flaked stone nodules. cores is listed in Appendix II as Variable 22 (V22).

Hammerstones

This is a logical variable that records the presence or absence of hammerstones (including core-hammerstones). Hammerstones are listed in Appendix II as Variable 23 (V23).

Hoes

This is a logical variable that records the presence or absence of flat, then marginally

retouched stone artifacts presumed to represent stone hoes or hoe fragments (Colton 1946a:286-287, Figure 163; King 1949:88, Figure 68; Smith 1952:121-123, Figure 46). The variable appears in Appendix II as Variable 24 (V24).

Basalt Cylinders

This is a logical variable that records the presence or absence of basalt cylinders, which are shaped, cylindrical artifacts, usually of vesicular basalt, that might have been used as tools for the shelling of corn (Colton 1946a:288, 290, Figure 166; King 1949:91-93, 108, 144, Figure 70; Smith 1952:127-129). The variable is listed in Appendix II as Variable 25 (V25).

Minimum Trash Dimension

This is a three-digit numeric code that records the minimum dimension, in meters, of the site's trash deposit as recorded on the field recording form or site map. A code of either 0 or 1 for this variable indicates that no trash area was defined for the site. In some cases, the site had no artifacts; in others, there were too few artifacts to warrant definition of a trash area; and in still others, a trash area was present, but its dimensions were not defined be the field recording crew. Regardless of the reason, a code of 0 or 1 indicates that the variable could not be defined. (Early in the coding process, a code of 1 for this variable, as well as for maximum trash dimension [see below], was used to indicate the presence of a single artifact at the site. Later, this convention was dropped in favor of a code of 0 to cover all cases in which a trash dimension could not be defined. Hence, a code of either 0 or 1 should be interpreted as a missing value.) Minimum dimension of trash deposit appears in Appendix II as Variable 26 (V26).

Maximum Trash Dimension

This is a three-digit numeric code that records the maximum dimension, in meters, of the site's trash deposit. As with the minimum trash dimension, a code of 0 or 1 indicates that no trash area was defined. The variable is listed in Appendix II as Variable 27 (V27).

Ceramic-Type Information

Because important aspects of this study are the determination of site occupation span and possible cultural affiliations of site inhabitants, detailed analysis of site ceramic assemblages was essential. Therefore, all ceramic information on the site field forms was computerized as a separate file. The extremely large size of this data file precludes its inclusion as an appendix, but its variables are described below.

Site Number

This variable is identical to that described above for the site-level data base. The coding of this variable in exactly the same format as that used in the site file allowed the site-level and ceramic assemblage information to be merged into a single data file for the purposes of analysis.

Data Type

This is a single-digit, numeric code that records the source and nature of the ceramic information. Five codes were employed. If the variable was coded as zero, this meant that the information on the ceramic assemblage at the site had been obtained from

a simple field assessment of which ceramic types were present. Thus, for sites fitting this data type (n = 776), the values of all ceramic types that were present were set to one, and absent types were assigned a value of zero. Since this level of information does not reflect the true proportions of ceramic types but only their presence or absence, sites with data type = 0 were excluded from all quantitative assessments of relative proportions of ceramic wares and types.

A code of data type = 1 (n = 1,569) indicates that the ceramic assemblage information was obtained by a complete or systematically derived count of ceramic types present at the site surface. All sites that were systematically searched for ceramics were coded in this manner, regardless of whether or not the search resulted in the observation of ceramics. Thus, even for those sites completely lacking ceramics, the variable was coded as data type = 1, so long as the field recording form made it clear that the site surface was adequately inspected.

A code of data type = 2 (n = 38) indicates that the ceramic assemblage information was obtained through the analysis of a systematic collection of surface artifacts. In all cases, the collections were obtained and analyzed as part of the Wupatki Survey.

A code of data type = 3 indicates that the data were obtained from published reports listing the frequencies of ceramic types recovered during excavation. Only seven sites fit this category: Wupatki Pueblo (WS 9991), excavated in 1933 and 1934 by Harold Colton and Lyndon Hargrave of the Museum of Northern Arizona (MNA) (Colton 1946a:55-63); Nalakihu (WS 9994), excavated in 1933 and 1934 by Dale King of MNA (King 1949); the four Big Hawk Valley sites (NA 618 [WS 473], NA 681 [WS 467], and NA 682 [WS 472]) excavated in 1948 by Watson Smith of MNA (Smith 1952); and a one-room masonry structure (NA 2077 WS 1405) excavated for the National Park Service in 1968 by Albert Ward (Ward 1978). It should be noted that because of apparent errors in Colton's (1946a:59) report of sherd counts from Room 7 at Wupatki (cf. Reed 1939), the sherds from Room 7 are not included in the present data base.

There are seven cases (WS 1385, WS 1409, WS 1443, WS 1453, WS 1771, WS 2575, and WS 2596) for Which there was no reliable information on the ceramic assemblages. As discussed above, sites WS 1385, WS 1443, and WS 1453 were considered by survey crew members to have possibly been contaminated by sherds originating from nearby Wupatki Pueblo, so the presence or absence of ceramics could not be ascertained. For the remaining four sites, it seemed clear from field recording forms that ceramics were present, but lists or counts of ceramics were either omitted or were said to be incomplete. Thus, all of these sites were coded as data type = 9 to indicate that the ceramic assemblage data were missing or unreliable.

In addition, some of the sherd assemblage information obtained from the Wupatki Survey field recording forms was supplemented with data from previous MNA surface sherd "grab" collections. The ceramic type counts for these collections, contained in the site files at MNA, were incorporated as follows. For sites with a data type code = 0, any types not recorded by the Wupatki Survey were added to the presence/absence sherd-type lists. For those sites coded as data type = 1 or = 2, type counts from the MNA collections were simply added to the total counts obtained by the Wupatki Survey. Table 5.1 provides a list of the previously collected MNA sites that contributed supplementary information on surface ceramic assemblages.

TABLE 5.1. Museum of Northern Arizona Sites Used to Supplement Wupatki Survey Ceramic Data.

Museum of Northern Arizona Site Number	Wupatki Survey Site Number
343	157
353	1717
354A	688
357	146
360	1635
368	1645
373	1636
377 and 378	1695
379	1692
382 and 383	1680
384	1679
404	1400
407	1395
537	831
538 and 545	833
546 and 554	834
556	891
624	1664
633 and 634	1027
636	1043
1182	2492
2795	1525
2820	164
2831	203
2835	80
2836	81
2838	141
2857	1597
2898	1586
2900	186
2902	170
2910	171
2912	183
2960	1666
2996	158
3907	1017

Types and Wares

A total of 78 ceramic categories--generally, established types and wares--were coded for presence/absence or frequency data in the ceramic assemblage data file. All of these variables were recorded as numeric values, with the field widths varying according to the maximum values observed across all cases. For example, particularly infrequent ceramic types or wares were often coded with as few as two digits, while some especially abundant types, such as Sunset Red, required as many as five digits to accommodate their maximum values. The nomenclature and coding decisions that were invoked in compiling the ceramic assemblage data file were guided by several references, particularly the works of Colton (1955, 1956, 1958) and Colton and Hargrave (1937).

Coded ceramic categories are listed below.

Tusayan White Ware. Kana-a, Black Mesa, Black Mesa/Sosi, Sosi, Dogoszhi, Shato, Flagstaff, Wupatki, Tusayan, and Kayenta Black-on-White; unidentified Tusayan White Ware; and other Tusayan White Ware.

Little Colorado White Ware. Holbrook, Holbrook Variety A, Holbrook Variety B, Chevelon, Walnut, Padre, and Leupp Black-on-White; unidentified Little Colorado White Ware; and other Little Colorado White Ware.

San Juan Red Ware. Deadman's and Middleton Black-on-Red; and unidentified San Juan Red Ware.

Tsegi Orange Ware. Medicine and Tusayan Black-on-Red; Cameron, Citadel, Tsegi, Kiet Siel, and Tusayan Polychrome; unidentified Tsegi Orange Ware; and other Tsegi Orange Ware.

Alameda Brown Ware. Rio de Flag, Winona, Angell, and Young's Brown; Sun-

set Red/Sunset Brown; Turkey Hill and Winona Reds; Winona Corrugated; Winona Smudged; Winona/Angell Brown; Sunset White-on-Red; unidentified Alameda Brown Ware; and other Alameda Brown Ware.

Tusayan Gray Ware. Lino Black-on-Gray; Lino, Kana-a, Coconino, Medicine, and Kiet Siel Grays; Tusayan and Moenkopi Corrugated; Honani Tooled; unidentified Tusayan Gray Ware; and other Tusayan Gray Ware.

San Francisco Mountain Gray Ware. Deadman's and Floyd Gray; Deadman's and Floyd Black-on-Gray; and Deadman's Fugitive Red.

Prescott Gray Ware. Prescott Gray; Prescott Black-on-Gray; Aquarius Orange; and Aquarius Black-on-Orange.

Exotic Decorated Ware. White Mountain Red Ware; unidentified red-on-buff; Coconino and Winona Red-on-Buff; unidentified decorated; proto-Hopi yellow ware; and other decorated.

Exotic Undecorated Wares. Little Colorado, Black Falls, and Elden Corrugated; proto-Hopi yellow ware; unidentified undecorated; and other undecorated.

Chronology

Although the scope of work defined for this study noted that ceramic dating had been accomplished for each site recorded by the inventory survey, this was true in only a limited sense. In nearly all cases, the only chronological information recorded on site field recording forms was an assignment to a Pecos Classification stage-level category, e.g., Pueblo II or Pueblo III. There are several problems with using this degree of chronological resolution for the present settlement-pattern analysis. First, there does not appear to have been a great deal of consistency in the assignment of stage-level categories. To one field worker, a certain ceramic assemblage might have indicated a Pueblo II classification, while to another an identical or closely similar assemblage apparently indicated something else (for example, Pueblo III, or a combination of both Pueblo II and Pueblo III). Second, the dates intended for these stages are not always clear--a factor which may have resulted in an additional lack of consistency. Some field workers occasionally offered a set of calendrical dates to accompany their stage-level assignments, but in the majority of cases, such dates were lacking or even contradictory with those given by another field worker referring to the same stage. Finally, the degree of resolution offered by stage-level dating is inadequate for most of the analytic goals of this project. The vast majority of sites were dated simply as Late Pueblo II/Early Pueblo III or Pueblo II/Pueblo III. Most of the sites recorded by the survey were therefore assigned only a rather vague post-eruptive date, inadequate for revealing the nature of prehistoric Wupatki-area settlement changes.

The Dating Method

A more consistent approach to ceramic dating was needed to alleviate these problems and to narrow the estimates of potential sit-occupation spans. Because the most frequently recorded category of ceramic information on field recording forms was a presence/absence list of ceramic types, it was decided to base potential occupation dates on the presence of key tree-ring-dated ceramic types. The dating method used in this study is a variant of the "ceramic group" dating approach pioneered by Harold S. Colton (1932:12-13, 1946a:18-23, 248-254), and later modified by John P.

Wilson (1969:210-214, Table 2). In this method, both decorated and plain-ware ceramic types are used to assign sites to ceramic groups that are believed to represent relatively restricted temporal intervals (referred to hereafter as Periods) during which particular sets of ceramic types were used and deposited. The ceramic groups employed in the present study are based on the schemes presented by Colton (1946a:18-23, 248-254) and Wilson (1969:Table 2) and the ceramic-type date ranges provided of Breternitz (1963, 1966), as these have been modified by consideration of more recent tree-ring evidence from the Flagstaff area (Robinson et al. 1975).

Periods, Dates, and Associated Ceramics

Periods and their ceramic criteria (ceramic groups) are given below.

Period 1 (Pre-A.D. 1064, i.e., prior to the eruption of Sunset Crater)

Kana-a Black-on-White, Lino Black-on-Gray, or Deadman's Black-on-Red, and Lino Gray, Kana-a Gray, Medicine Gray, Coconino Gray, or Rio de Flag Brown.

Period 2 (A.D. 1064-1130)

Black Mesa Black-on-White or Holbrook Variety A Black-on-White, and Tusayan Corrugated, Deadman's Gray, Deadman's Fugitive Red, or Winona Brown.

Period 3 (A.D. 1130-1160)

Sosi Black-on-White, Holbrook Variety B Black-on-White, Dogoszhi Black-on-White, or Cameron Polychrome, Tusayan Corrugated, and Moenkopi Corrugated.

Period 4 (A.D. 1160-1220)

Flagstaff Black-on-White, Walnut Black-on-White, Citadel Polychrome, or Tusayan Polychrome, and Moenkopi Corrugated, Sunset Red, Sunset Brown, or Turkey Hill Red.

Period 5 (A.D. 1220-1275)

Tusayan Black-on-White or Leupp Black-on-White, and Moenkopi Corrugated, Sunset Red, Kiet Siel Gray, or Turkey Hill Red.

Period 6 (Post-A.D. 1275)

Kayenta Black-on-White, Tsegi Polychrome, or St. John's Polychrome, and Kiet Siel Gray or undecorated Proto-Hopi yellow ware.

Limitations of the Method

Several problems in this dating scheme are recognized. First, it is acknowledged that ceramic groups are ideal constructs, which are intended to reflect composite regional ceramic assemblages in use during particular time periods. Potentially significant sources of synchronic variability in ceramic assemblages, attributable to spatial, social, or functional factors, have not been considered in creating the present groups or in applying their criteria to individual sites. Second, it is admitted that there are inherent risks in applying ceramic-group dating criteria to ceramic data that have been recorded in a simple presence/absence fashion. Because such data are binary, extremely low frequencies of ceramic types are

accorded the same chronological significance as types that are particularly abundant. Thus, although ceramic-group dating has traditionally included the options of ignoring low-frequency type occurrences as potential classification errors or dismissing such occurrences as evidence of non-occupational site use (Colton 1946a:118), these options could not be exercised in the present analysis.

It must also be admitted that many of the individual types used to define the groups are known to have been used at times other than the indicated group dates, and it is quite possible to assign a site, simply on the basis of a presence/absence list, to a period or periods before or beyond its true occupation dates. This is particularly true when the sherd-sample size is large. Further, as pointed out by Colton (1946a:36), even when the former problems do not apply, ceramic-group dates provide only lower and upper limits to a site's potential occupation span and not an estimate of its true occupation dates, which may be considerably more restricted than the overall ceramic-group date range. Finally, ceramic groups represent arbitrary and unequal temporal intervals, defined entirely on the basis of perceived shifts in ceramic assemblages that may or may not have been correlated with other significant cultural changes.

Weaknesses in the available data base must also be acknowledged. The ceramic-type counts that were used to date sites came from a variety of sources, including surface sherd counts, systematic surface collections, presence/absence surface inventories, and excavated sherd counts. These data were accumulated at various times by various workers, and their comparability could not be assessed. Many ceramic assemblages were exceedingly small, especially in areas where visitors may have collected significant numbers of surface artifacts. Also, particularly in the northern part of the Monument, cattle had trampled surface sherds, breaking many of them into pieces too small for type identification. All of these factors have affected the quality and comparability of the ceramic-type data, and potential effects on dating efforts remain unknown.

Nonetheless, we believe that the present endeavor is a substantial improvement over the chronological information included on the field recording forms, and that it constitutes a reasonable first approximation of the sequence of prehistoric occupation and land use within the Monument. As with all other analysis presented in this report, chronological information is offered with the full realization that survey data must be interpreted cautiously, and with the hope that future studies can test and refine our methods and conclusions.

General Results

Using the dating method described above, 977 sites could be assigned to one or more time periods. Of this total, 513 were assigned to a single period only; 310 were assigned to two periods; 122 were assigned to three periods; and 32 sites spanned four time periods. Table 5.2 provides breakdowns for specific combinations of time periods.

As may be deduced from Table 5.2, 1,627 periods were represented at the 977 dated sites. The periods were distributed as follows: Period 1,2 sites (Figure 5.1); Period 2, 147 sites (Figure 5.2); Period 3, 461 sites (Figure 5.3); Period 4, 809 sites (Figure 5.4); Period 5, 208 sites (Figure 5.5); and Period 6, 0 sties. These results indicate a negligible use or occupation of Wupatki National Monument in pre-eruptive times; increasingly intensive occupation and land use in Periods 2, 3, and 4; a sharp decline in sites

TABLE 5.2. Results of Ceramic-Group Dating.

	Number of Sites	Percent
Period 1	2	.1
Period 2	18	.8
Period 3	99	4.1
Period 4	369	15.4
Period 5	26	1.1
Periods 2 and 3	15	.6
Periods 2 and 4	25	1.0
Periods 2 and 5	3	.1
Periods 3 and 4	194	8.1
Periods 4 and 5	67	2.8
Periods 2, 3, and 4	47	2.0
Periods 2, 4, and 5	6	.3
Periods 3, 4, and 5	69	2.9
Periods 2, 3, 4, and 5	32	1.3
Undated	1,420	59.2
TOTAL	2,397	100.0

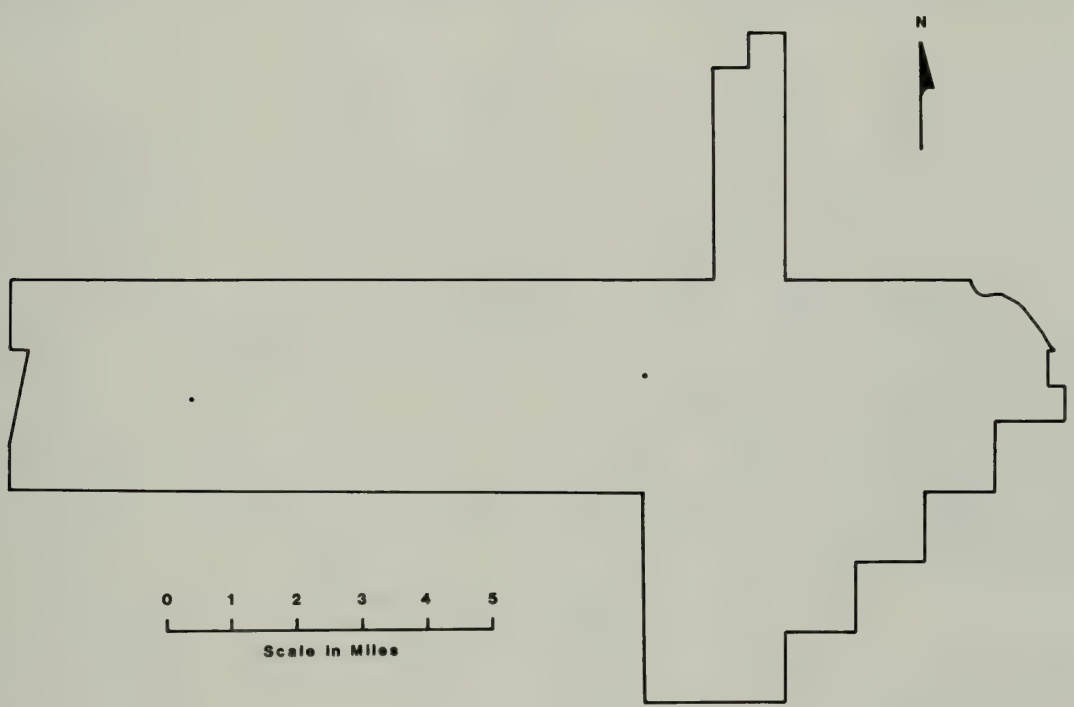


FIGURE 5.1. Wupatki National Monument, Period 1 Sites.

FIGURE 5.2. Wupatki National Monument, Period 2 Sites.

FIGURE 5.3. Wupatki National Monument, Period 3 Sites.

FIGURE 5.4. Wupatki National Monument, Period 4 Sites.

FIGURE 5.5. Wupatki National Monument, Period 5 Sites.

during Period 5; and complete abandonment of the Monument sometime prior to Period 6. These trends will be discussed in more specific terms in the sections that follow.

Descriptive Summary of Site Types and Site Characteristics

In this study, 2, 397 sites are assigned a prehistoric temporal affiliation (Figure 5.6) . The majority of these sites (n = 2,064) are classified as prehistoric on the basis of associated artifacts. For the remainder, the assignment is based on a lack of resemblance to known historic features or sites (e.g., NPS "rock dumps," formed during road construction or stabilization activities) or a lack of resemblance to known Navajo features or sites (e.g., corrals, sweat lodges, etc.; see Roberts, this volume). Further research, of course, should be conducted to verify the latter assignments, but given the documented intensity of prehistoric occupation and land use at Wupatki National Monument, it seems reasonable to assume for now that most of the sites without artifacts and historic or Navajo analogues indeed date to the prehistoric period.

Ten prehistoric site types are recognized. The most abundant category (n = 2,209), Site Type 0, consists of sites having architectural remains that could be identified as masonry rooms, pit structures, or "enclosures" (see The Data Base, above). These sites will be discussed in a later section of this chapter. The remaining eight site types (n = 188) are described below.

FIGURE 5.6. Wupatki National Monument, All Prehistoric Sites (n = 2397).

Sites without Architectural Remains

The purpose of this discussion is to describe the basic characteristics of the 188 sites that lack architectural remains. Because of space limitations, and given currently irresolvible questions regarding both the field identification of individual sites and the general validity of the taxonomy employed, no detailed analyses are attempted. Further field research is recommended to assess the true range of prehistoric activities conducted at each site type ant to evaluate whether the present site type represent useful analytical divisions.

Site Type 1: Artifact Scatter

Twenty-nine sites, ranging in size from 21 to 5,600 square meters, are classified as artifact scatters. This site category is somewhat problematic because it may not have been consistently recorded, either in different geographical zones or at different times during the course of the Wupatki Survey. Much of the apparent inconsistency is understandable given the nature of surface artifact distributions in some portions of the Monument. For example, on river terraces along the Little Colorado River, lithic debitage, cores, and hammerstones are often widely distributed at a low density, leading to severe problems in site boundary definition (e.g., Keller 1984). In these areas, a common survey practice was simply to note the scatters on field maps as "resource areas" and ignore them as sites. For other areas, where the density of architectural sites was high, it was often difficult to decide whether a particular artifact scatter should be considered as trash originating from a nearby site with visible architectural remains or recorded separately as an artifact scatter site. Thus, many artifact localities that might well have been defined as artifact scatters were never recorded as sites, while others that were so counted might just as easily have been ignored by a different survey crew.

Tables 5.3 and 5.4 list the assemblage characteristics of the 29 artifact scatter sites, and Table 5.5 lists inferred periods of occupation or use. Figure 5.7 depicts site locations.

TABLE 5.3. Artifact Frequency Data for Site Types 1-8.

	SITE TYPE							
	1	2	3	4	5	6	7	8
Missing Data		2						1
None		24	3	10	9	2	8	1
1 - 10	2	30	4	7	4	3	8	1
11 - 25	7	6	1	4	1	3	2	
26 - 100	8	6	3	5	2			
101 - 500	10		3	2				1
501 - 1,000	1		1					
> 1,000	1							

TABLE 5.4. Representation of Artifact Classes at Site Types 1-8.

	SITE TYPE							
	1	2	3	4	5	6	7	8
Ceramics	26	32	12	15	5	3	8	3
Debitage	22	18	5	10	3	5	4	1
Flaked Tools	8	7		1		1	1	
Ground Stone	9	2	2	2			3	1
Cores	7	4	2	1	3	1		
Hammerstones	7						1	
Hoes	2	4	1					
Basalt Cylinders	1							

TABLE 5.5. Periods of Occupation or Use for Site.

	SITE TYPE							
	1	2	3	4	5	6	7	8
Period 1				1				
Period 2	1							
Period 3	1	1		2				
Period 4	1	5	4		1	1	1	
Period 5		2						
Period 2 and 3				1				
Period 2 and 4	1							
Period 3 and 4	2			2				2
Period 4 and 5	2		2					
Period 2, 3, and 4		1		1				
Period 3, 4, and 5	1		1					
Undated	20	59	8	21	15	17	17	2

Site Type 2: Agricultural Field

Sixty-eight sites are defined as agricultural fields. As with artifact scatters, the field identification of this site type may have been somewhat inconsistent. Although agricultural features are abundant in various portions of the Monument (Marozas 1983), a common practice on the Wupatki Survey was to record individual features as components of other site types (see Travis, this volume). Thus, those agricultural features that were recorded as separate sites were usually so designated for one of two reasons. Either they were too far removed from another site type to be easily incorporated as components of that site, or they represented especially well-preserved or unusual examples of a particular feature type.

Tables 5.3 and 5.4 provide data on the assemblages of agricultural sites, and Table 5.5 lists inferred periods of occupation or use. Figure 5.8 shows site locations

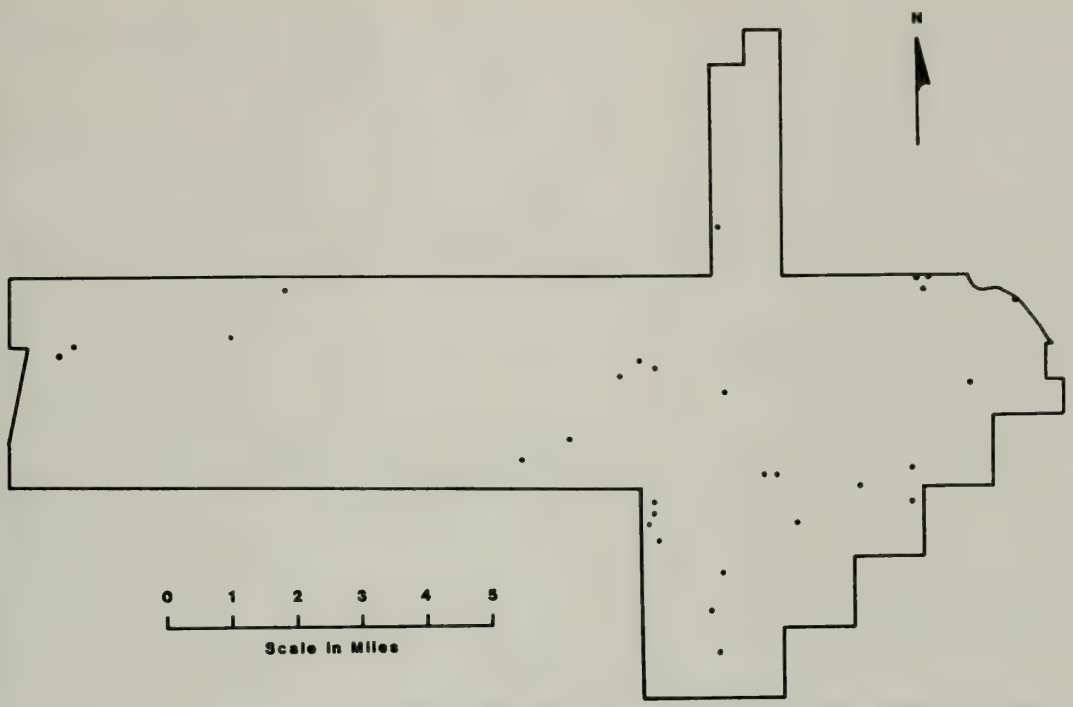


FIGURE 5.7. Wupatki National Monument, Artifact Scatters (Site Type = 1).

Site Type 3: Reservoir

Fifteen sites are classified as prehistoric reservoirs, defined either as areas modified to retain runoff or as natural water basins that appeared from artifacts or other evidence to have been used as sources of domestic water. Detailed discussions of certain examples of this site type are provided by Marozas (1983:110-131) and Ritterbush (1984). It should be noted the reservoir sites defined in this study do not represent all of the prehistoric reservoirs or catchments at Wupatki National Monument. Rather, they represent only those reservoirs or catchments that did not exhibit architectural spaces or other features that would have required an alternate site classification.

Assemblage attributes and inferred periods of use for reservoir sites are listed in Tables 5.3, 5.5, and 5.6. Figure 5.9 shows site locations.

Site Type 4: Cists, Hearths, or Other Upright Slab Features.

Twenty-eight sites are assigned to this category, which was created to account for small, upright rock constructions that did not appear to have been used as shelters. These sites may represent the remains of extramural hearths, mealing bins, storage cists, or graves.

Data on the assemblages of cist sites are given in Tables 5.3 and 5.4. Table 5.5 lists the inferred periods of use, and Figure 5.10 shows site locations.

Site Type 5: Building-Stone Quarry

Sixteen sites are classified as building-stone quarries. this site type refers to locations where bedrock appeared to have been removed, reduced, or dressed, presumably to provide construction materials for prehistoric sites. At least two cautions are in order

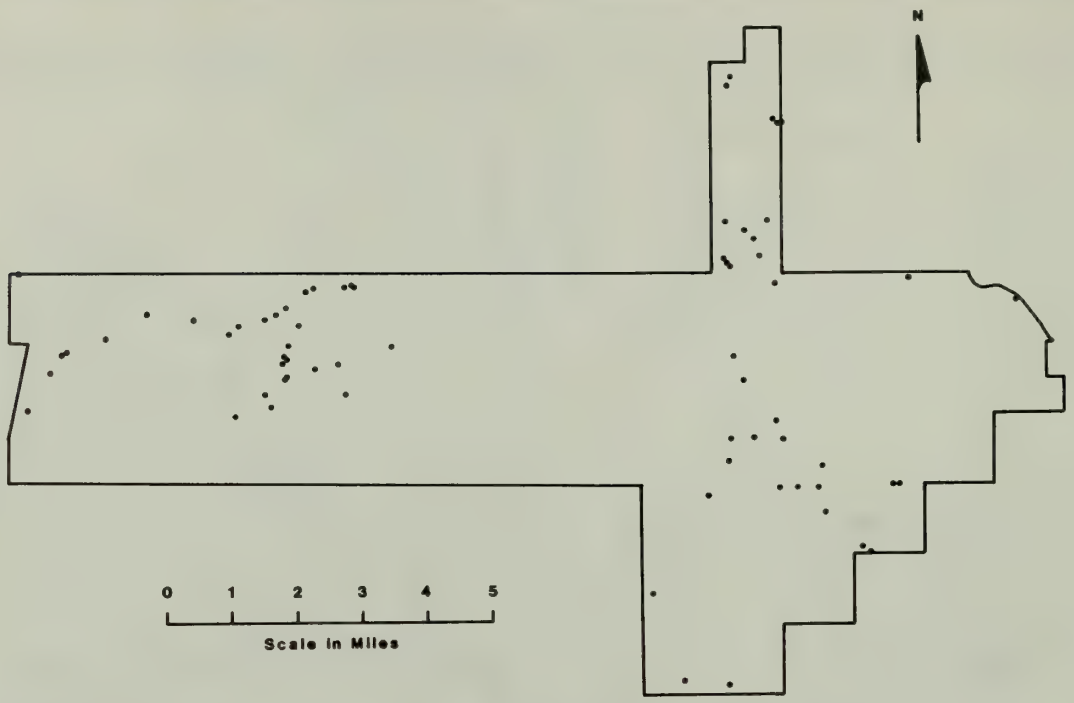


FIGURE 5.8. Wupatki National Monument, Agricultural Sites (Site Type = 2).

TABLE 5.6. Frequency of Architectural Spaces.

Number of Architectural Spaces	Frequency	Percent	Cumulative Percent
1	1,080	56.221	56.221
2	390	20.302	76.523
3	170	8.850	85.372
4	73	3.800	89.172
5	41	2.134	91.307
6	49	2.551	93.857
7	22	1.145	95.003
8	22	1.145	96.148
9	15	0.781	96.929
10	9	0.469	97.397
11	11	0.573	97.970
12	8	0.416	98.386
13	6	0.312	98.699
14	5	0.260	98.959
15	4	0.208	99.115
16	1	0.052	99.167
17	1	0.052	99.271
20	4	0.208	99.479
22	3	0.156	99.636
23	1	0.052	99.688
24	1	0.052	99.740
25	2	0.104	99.844
33	1	0.052	99.896
51	1	0.052	99.948
102	1	0.052	100.000

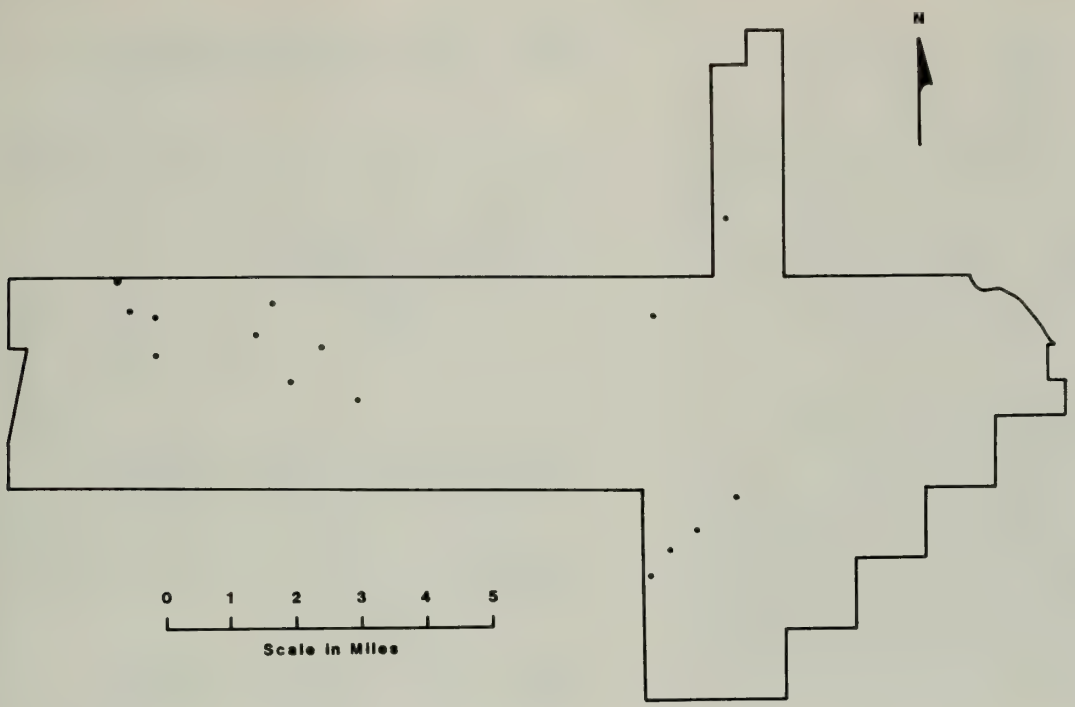


FIGURE 5.9. Wupatki National Monument, Reservoir Sites (Site Type = 3).

FIGURE 5.10. Wupatki National Monument, Cist Sites (Site Type = 4).

with respect to this site type. First, field identification of quarry locations was undoubtedly difficult owing to the many natural processes that might result in the appearance of quarrying activity. Second, it may be that at least some quarry sites were created or used by the Navajo residents of Wupatki National Monument, who have also built a number of stone structures. For these reasons, further research is recommended at each quarry site before they are accepted as a valid prehistoric site category.

Assemblage attributes and inferred dates of use for quarry sites are given in Tables 5.3, 5.4, and 5.5. Figure 5.11 shows site locations.

Site Type 6: Prehistoric Shrine

Eight sites are classified as prehistoric shrines. This site type is extremely problematic, and it represents a more

Figure 5.12.Wupatki National Monument, Shrine Sites (Site Type = 6).

or less residual category reserved for rock piles, stacked rock constructions, or other features or feature-and-artifact combinations that could not easily be accommodated by any other site category.

Tables 5.3, 5.4, and 5.5 give assemblage attributes and inferred periods of use for "shrine" sites. Figure 5.12 depicts site locations.

Site Type 7: Petroglyph Site

Eighteen sites are counted as petroglyph localities without attributes that would force classification as another site type. As noted in The Data Base above, this

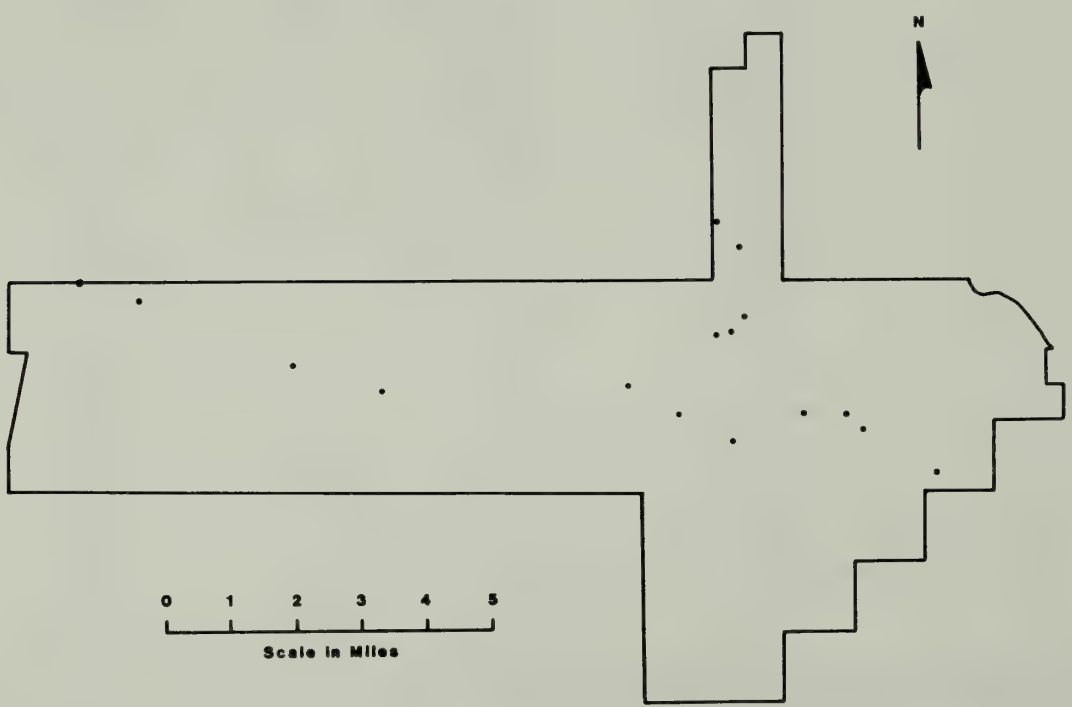


FIGURE 5.11. Wupatki National Monument, Quarry Sites (Site Type = 5).

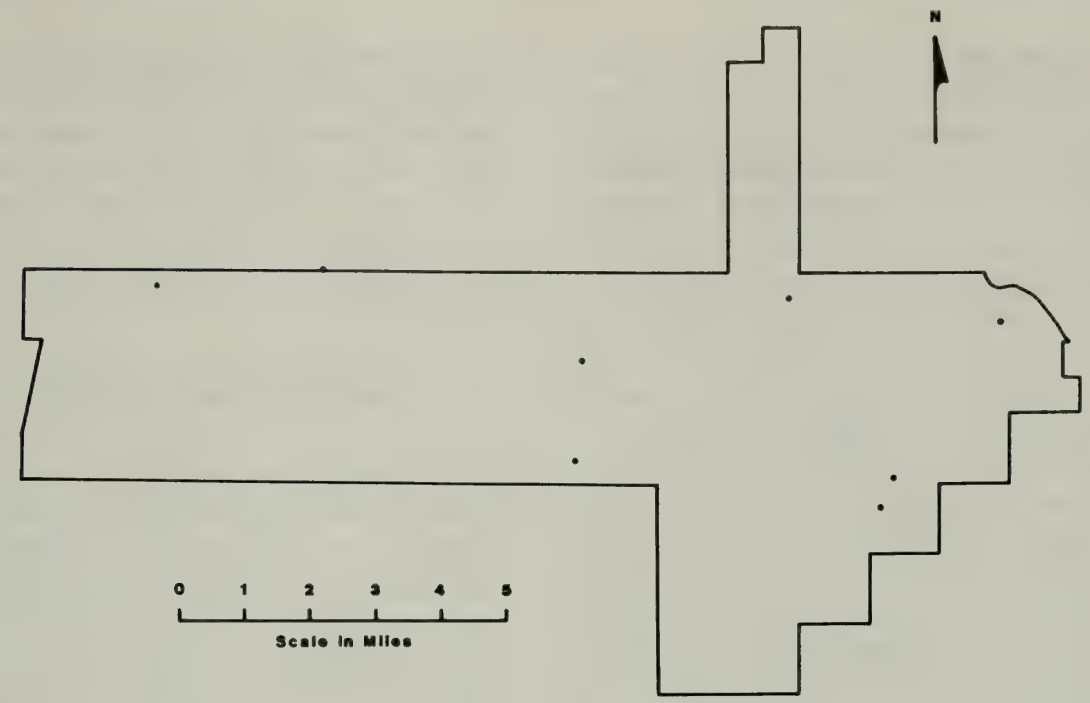


FIGURE 5.12. Wupatki National Monument, Shrine Sites (Site Type = 6).

site type represents only a fraction of all petroglyph localities at Wupatki National Monument, for in addition to the 18 petroglyph sites, 85 sites include rock art as a site feature. Attributes of artifact assemblages from petroglyph sites are given in Tables 5.3,and 5.4. Table 5.5 lists the results of attempts to date the sites from ceramic evidence. Figure 5.13 shows the locations of the 18 petroglyph sites, as well as the 85 sites with petroglyphs recorded as a site feature.

Site Type 8: Burial Area

Four sites are considered prehistoric burial areas. This site type is defined on the basis of slab cists resembling graves or other features that might indicate prehistoric burials. One of the sites (WS 79) has been identified as a prehistoric cemetery on the basis of a published account that describes slab-lined graves, broken pottery, human remains, and other items unearthed by pothunters in the late teens or early 1920s (Barrett 1927:26-27, Figures 16-17, 21-22; see also Colton 1946a:52). Of course, these sites do not represent all of the inferred prehistoric burial locations at Wupatki National Monument, only those sites that might contain burials but could not be assigned to some other site category.

Assemblage attributes of grave sites are provided in Tables 5.3 and 5.4 and period assignments are given in Table 5.5. Figure 5.14 depicts site locations.

Site Type 9: Isolated Artifact of Special Significance

This site category comprises only two examples, both of which were recorded as sites to mark the location so two highly unusual finds: an isolated, intact Clovis point (WS 1340) and a large, complete prehistoric basket that had been cached in an earth crack (WS 1603). The Clovis point evidently

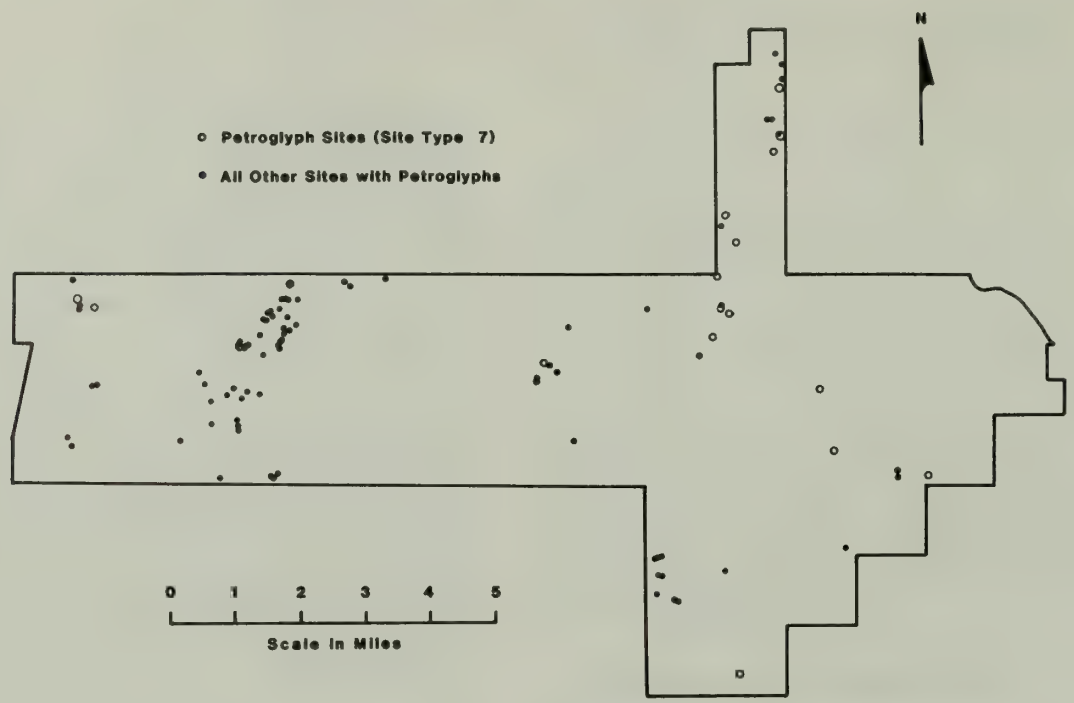


FIGURE 5.13. Wupatki National Monument, Petroglyph Sites and Localities.

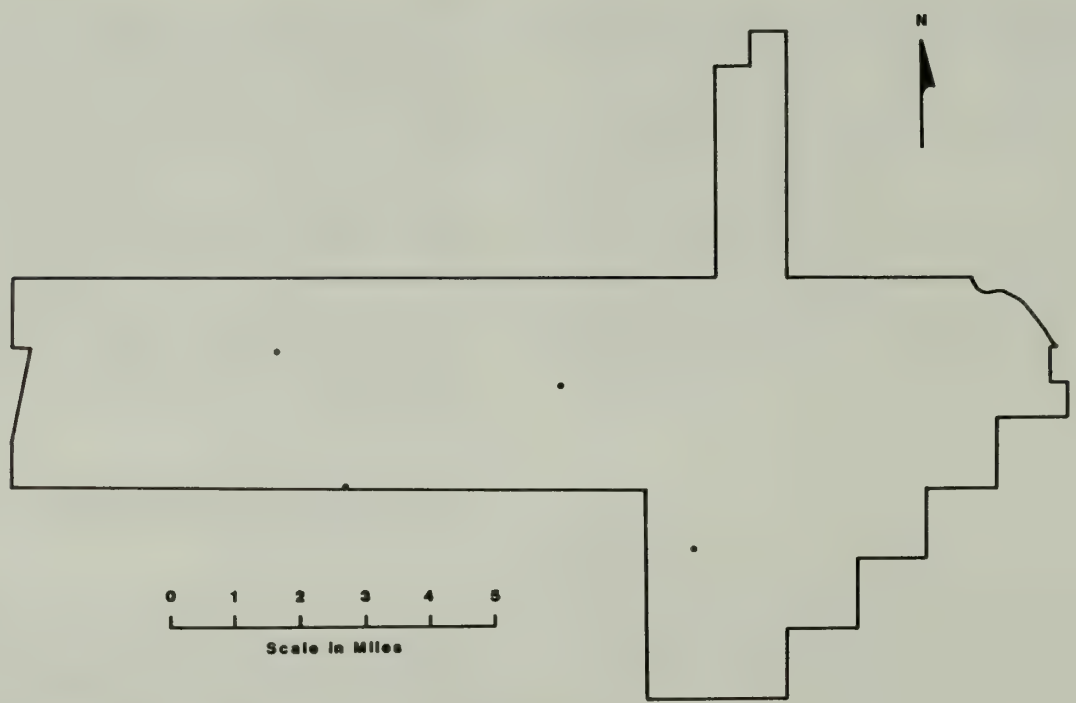


FIGURE 5.14. Wupatki National Monument Burial Sites (Site Type = 8).

had been lost during the Paleoindian period, ca. 11,500 years ago, and had only recently been exposed by aeolian erosion. The basket could not be dated with precision, but it apparently had been manufactured and cached during the latter part of the prehistoric pueblo occupation, perhaps around A.D. 1200.

Sites with Architectural Remains

A total of 2,209 sites are classified as Site Type 0, or sites having some surface or subterranean construction that forms a potential prehistoric shelter. Of this total, 288 are classified as "enclosure" sites, lacking any construction with a maximum 1,921 sites with "architectural spaces" exceeding two meters in width (Table 5.6), 1,080 consist of a single space, either a single masonry room (n = 1,046) or a single indication of a pit structure (n = 34).

There are 390 sites with two architectural spaces. Seven of these have two apparent pit structures, 27 consist of a single masonry room and a pit structure, and 356 are composed of two masonry rooms. Of the 356 two-room sites, 131 are formed by two separate structures and 225 consist of a single structure with two rooms.

The bulk of the remaining 739 architectural sites have fewer than ten architectural spaces. There are 169 sites with three spaces, 73 with four, 41 with five, 49 with six, 22 each with seven and eight, 15 with nine spaces, and nine sites with 10 architectural spaces. Thus, more than 97 percent of all architectural sites at Wupatki National Monument consist of ten or fewer architectural spaces. Of the remaining sites with more than ten sites have more than 20.

Evident pit structures or presumed structure depressions occur at 189 sites. Table 5.7c lists the frequency of pit structures, broken down by the frequency of accompanying masonry rooms. As with all data regarding pit structures, Table 5.7 should be interpreted with caution. It seems certain that many of the putative "structural" depressions identified by surveyors do not represent pit structures, and equally certain that many sites without visible subsurface structures in fact do have one or more pit houses or kivas (e.g., Smith 1952:16).

In any case, of the sites represented in Table 5.7 the great majority (123 of 189, or 65%) have only a single pit structure. Thirty-eight (20%) have two, and only 28 (15%) have three or more. Forty-seven sites have one or more pit structures or depressions but no masonry rooms, and 36 of the sites are accompanied by only a single surface room.

Table 5.8 lists the architectural attributes of all 2,209 Wupatki sites with structural remains. As the table shows, very few of the sites with surface architecture (181 of 2,162, or 8%) appear to have some structure with a wall height of one meter or more, and only a tiny fraction (29 of 2,162, or slightly more than 1%) are thought to have upper story rooms (Figure 5.15). More than one-fourth (n = 553) of all sites with surface architecture incorporate bedrock into the main structure, and more than 23% (n = 507) have wing walls, free-standing walls, or both. Of the 2,150 sites with both surface architecture and a field record of the building material that was used, nearly one-half (1,008, or 47%) were built primarily of basalt, and more than one-third (741, or 34%) are composed primarily of limestone. A relatively small proportion (142, or about 7%) of all sites was built of sandstone or a combination of materials where no single stone type was dominant.

Tables 5.9 and 5.10 list the attributes of artifact assemblages that were observed at all sites with architectural remains. One

TABLE 5.7. Number of Depressions, by Number of Masonry Rooms.

Number of Masonry Rooms	Number of Depressions						
	1	2	3	4	5	6	10
0	34	7	2	1		2	1
1	27	7	1		1		
2	11	3	1	1	1		
3	8	2		2	1		
4	9	2					
5	15	2	1	1			
6	4	4	2		1		
7	3	1	2		1		
8	4		1	1			
9	1	3					
10	1	1		1			
11		2	1	1			
12	1						
14	1	1					
17			1				
18		1					
19	1						
21	1						
24	1						
50	1						
100		1					
TOTAL	123	38	12	8	5	2	1

TABLE 5.8. Architectural Data for All Sites with Architecture.

Wall Height > 1 meter	181
Upper-Story Rooms Present	29
Bedrock in Wall	553
Wing Wall Present	306
Freestanding Wall Present	135
Wing and Freestanding Walls Present	66
Basalt Primary Building Material	1,008
Limestone Primary Building Material	741
Sandstone Primary Building Material	259
Mixed, No Dominant Building Material	142
Missing Data on Building Material	12
No Masonry Present	47

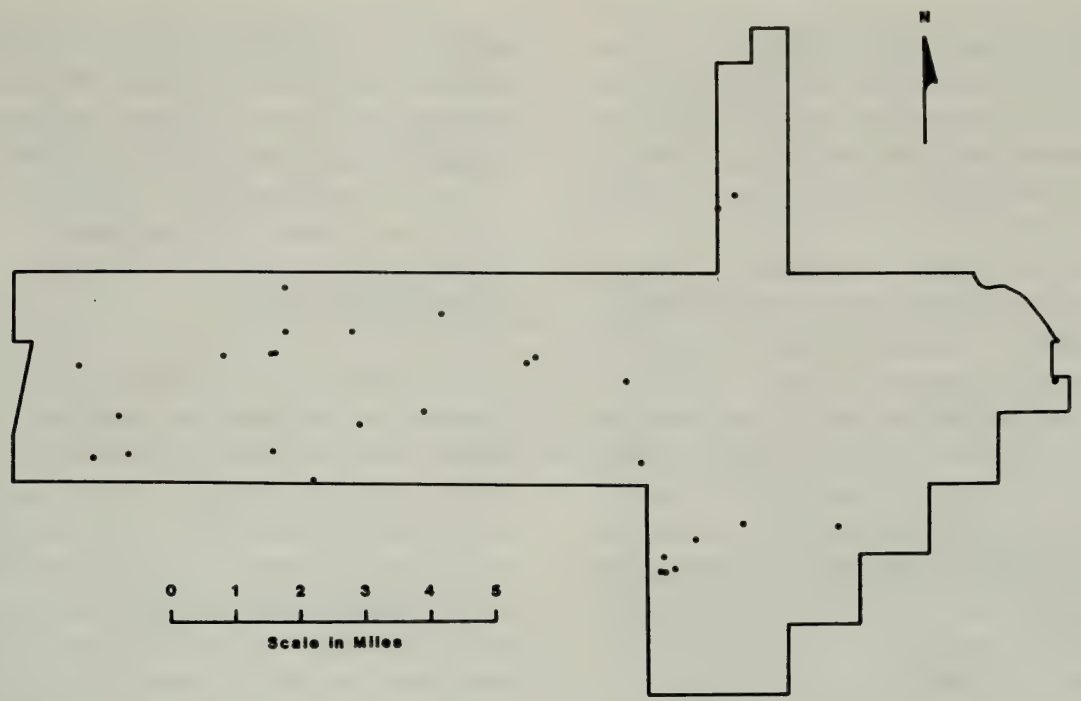


FIGURE 5.15. Wupatki National Monument Multiple Story Pueblos.

trend that is immediately evident is that the great majority of sites either lack artifacts completely or have only a few items visible at the surface. Of the 2, 193 sites having an estimate of the absolute frequency of surface artifacts, more than 83% (n = 1,815) have fewer than 101 items, and more than 60% (n = 1,318) have fewer than 26. Over 11% (n = 246) of the sites with inferred prehistoric architectural remains have no surface artifacts. The areas of the trash deposits associated with each site are also quite small. For 1,047 sites having both surface artifacts and a field measurement of trash area, the average dimensions are 17m by 23m.

For the major artifact categories, ceramics are particularly common, occurring at 86% (n = 1,866) of all sites with architectural remains. Chipped stone debitage was observed at 58% of such sites, and ground stone tools at 474. The co-oc-

TABLE 5.9. Artifact Frequency Data for All Sites with Architecture.

Missing Data	27
No Artifacts	244
1 - 10	646
11 - 25	427
26 - 100	497
101 - 500	246
501 - 1,000	62
> 1,000	60

TABLE 5.10. Representation of Artifact Classes at All Sites with Architecture.

Ceramics	1,866
Debitage	1,313
Flaked Stone Tools	293
Ground Stone	474
Cores	207
Hammerstones	119
Hoes	167
Basalt Cylinders	30

currences of major artifact categories are as follows: Ceramics and debitage were observed at 1,244 sites, ceramics and ground stone at 464, debitage and ground stone at 396, and ceramics, debitage, and ground stone at 393.

Table 5.11 lists the inferred periods of occupation or use for all sites with architectural remains. Temporal trends for these sites parallel the general trends for all sites. There is negligible evidence for a pre-eruptive occupation or use of the Monument, a relatively small-scale occupation or use in Period 2, a great increase in site formation during Periods 3 and 4, and a sharp decline in dated sites for Period 5. Again, since no site could be assigned to Period 6, there is no ceramic evidence for a significant occupation or use of Wupatki National after about A.D. 1275.

TABLE 5.11. Periods of Occupation or Use for All Sites with Architecture.

Period 1	1
Period 2	17
Period 3	95
Period 4	356
Period 5	24
Period 2 and 3	14
Period 2 and 4	24
Period 2 and 5	3
Period 3 and 4	188
Period 3 and 5	5
Period 4 and 5	63
Period 2, 3, and 4	45
Period 2, 4, and 5	6
Period 3, 4, and 5	67
Period 2, 3, 4, and 5	32
Undated	1,269

What follows is a description of architectural sites broken down by eight formal divisions: (1) "enclosure" sites; (2) single-room masonry sites; (3) sites with evidence of a single pit structure and no masonry structures; (4) sites showing evidence of multiple pit structures and no masonry structures; (5) sites with two to six architectural spaces; (6) sites with seven to 10 architectural spaces; (7) sites with 11 to 20 architectural spaces; and (8) sites with more than 20 architectural spaces.

Enclosure Sites

Attributes of enclosure sites seem generally to support the notion that they were not used for habitation or other activities that would require an enclosed shelter or would result in the deposition of significant quantities of artifacts (Tables 5.12, 5.13, and 5.14). Of 288 enclosure sites, only 5 (slightly less than 2%) were judged to have a wall height of al least one meter, none has multiple stories, and only 25 (9%) have wing or free-standing walls. A majority (54%; n = 154) of all enclosure sites were constructed of basalt, followed by limestone at 33% (n = 96), mixed materials at 7% (n = 19), and sandstone at 6% (n = 18). For the 286 sites having a field record of artifact frequency, none has more than 500 surface items, a very large majority (240, or 84%) have fewer than 26, and 26% (n = 74) have none. Ceramics are relatively abundant, occurring at 65% (n = 187) of all enclosure sites. Debitage and ground stone, however, are relatively infrequent, occurring at only 33% (n = 95) and 10% (n = 29), respectively, of all enclosure sites. Ceramics and debitage occur together at only 79 sites (27%), and a combination of ceramics, debitage, and ground stone occurs at only 17 sites (6%).

Table 5.15 lists the results of attempts to date enclosure sites from ceramic evidence. Not surprisingly, given the relative paucity of artifacts at these sites, few could be dated. Of the 45 dated enclosure sites, 76% (n = 34) were dated to a single period, most commonly Period 4 (n = 24). A few sites, how-

TABLE 5.12. Architectural Data for Enclosure Sites.

Wall Height > 1 meter	5
Upper-Story Rooms Present	0
Bedrock in Wall	70
Wing Wall Present	12
Freestanding Wall Present	9
Wing and Freestanding Walls Present	4
Basalt Primary Building Material	154
Limestone Primary Building Material	96
Sandstone Primary Building Material	18
Mixed, No Dominant Building Material	19
Missing Data on Building Material	1

TABLE 5.13. Artifact Frequency Data for Enclosure Sites.

Missing Data	2
No Artifacts	74
1 - 10	127
11 - 25	39
26 - 100	38
101 - 500	8
501 - 1,000	0
> 1,000	0

TABLE 5.14. Representation of Artifact Classes at Enclosure Sites.

Ceramics	187
Debitage	95
Flaked Stone Tools	13
Ground Stone	29
Cores	9
Hammerstones	2
Hoes	20
Basalt Cylinders	0

TABLE 5.15. Periods of Occupation or Use for Enclosure Sites.

Period 2	2
Period 3	6
Period 4	24
Period 5	2
Periods 2 and 3	1
Periods 3 and 4	5
Periods 3 and 5	1
Periods 4 and 5	1
Periods 2, 4, and 5	1
Periods 3, 4, and 5	2
Undated	243

ever, showed evidence of use during multiple periods, and three sites could be assigned to three periods.

Figure 5.16 shows the locations of enclosure sites.

Isolated Masonry Room Sites

Tables 5.16, 5.17, and 5.18 list the attributes of the architecture and artifacts observed at sites having only a single masonry room. As with enclosure sites, only a very few (19, or less than 2%) of the isolated masonry room sites have a wall height of one meter or more, and none has multiple stories. However, more than 17% (n = 181)

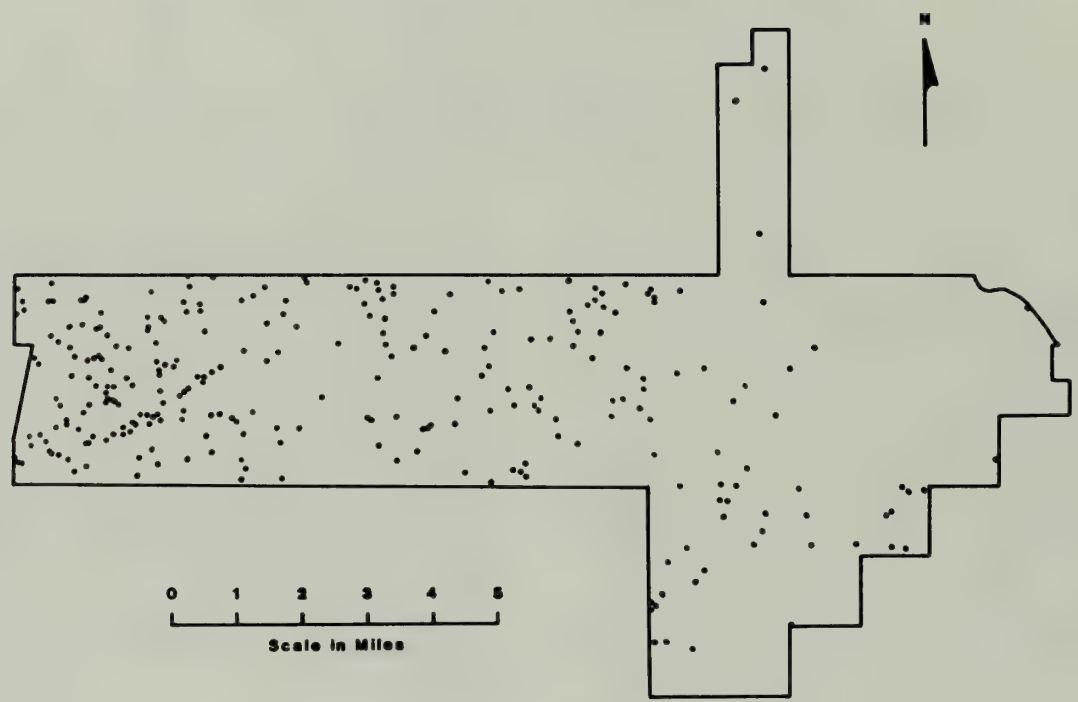


FIGURE 5.16. Wupatki National Monument Enclosure Sites.

of all isolated masonry rooms have wing or freestanding walls, or both, a proportion that is roughly double the frequency for enclosure sites. Basalt is the dominant construction material at nearly half (467 of 1,041, or 45%) of the sites with a record of building-material type, followed by limestone at 38% (n = 400) and sandstone at 10% (n = 104).

With respect to artifact frequency, it is evident that the overwhelming majority of isolated masonry rooms have very few, if any, artifacts. More than 74% of such sites with a record of artifact frequency (773 of 1,039) have fewer than 26 items, and nearly 14% (n = 144) have none. Compared to enclosure sites, the proportion of sites with more than 100 items is considerably higher (54, or slightly more than 5%), but it is nonetheless low. Only five sites have more than 500 surface items, and only a single site was judged to have more than 1,000. Ceramics are the most common artifact category, occurring at nearly 81% (n = 844) of all sites. Debitage and ground-stone artifacts occur at 52% (n = 544) and 13% (n = 138) of all sites. Co-occurrences of major artifact categories are as follows: ceramics and debitage occur at 500 sites, debitage and ground stone at 101, ceramics and ground stone at 133, and ceramics, debitage, and ground stone at 100 sites.

TABLE 5.16. Architectural Data for Isolated Masonry Room Sites.

Wall Height > 1 meter	19
Upper-Story Rooms Present	0
Bedrock in Wall	248
Wing Wall Present	123
Freestanding Wall Present	51
Wing and Freestanding Walls Present	7
Basalt Primary Building Material	467
Limestone Primary Building Material	400
Sandstone Primary Building Material	104
Mixed, No Dominant Building Material	70
Missing Data on Building Material	5

The results of dating efforts for isolated masonry room sites are given in Table 5.19. Figure 5.17 depicts the spatial distribution of all isolated masonry room sites.

Isolated Pit Structures

Isolated pit-structure sites are defined as those sites having only a single evident pit structure or putative structure depression and no masonry structures. As noted previously, surface indications of the number or even the presence of pit structures may not always be reliable. Thus, the following data, as well as data on sites with multiple pit structures (presented in a following section), are offered with the usual caveat regarding interpretations of survey evidence.

TABLE 5.17. Artifact Frequency Data for Isolated Masonry Room Sites.

Missing Data	7
No Artifacts	144
1 - 10	385
11 - 25	244
26 - 100	212
101 - 500	49
501 - 1,000	4
> 1,000	1

TABLE 5.18. Representation of Artifact Classes at Isolated Masonry Room Sites.

Ceramics	844
Debitage	544
Flaked Stone Tools	104
Ground Stone	138
Cores	77
Hammerstones	39
Hoes	75
Basalt Cylinders	2

TABLE 5.19. Periods of Occupation or Use for Isolated Masonry Room Sites.

Period 1	1
Period 2	5
Period 3	39
Period 4	153
Period 5	10
Periods 2 and 3	8
Periods 2 and 4	10
Periods 3 and 4	65
Periods 3 and 5	2
Periods 4 and 5	12
Periods 2, 3, and 4	9
Periods 3, 4, and 5	7
Periods 2, 3, 4, and 5	1
Undated	724

Assemblage attributes for isolated pit-structure sites are given in Tables 5.20 and 5.21. Artifact frequencies are highly variable, but values are generally higher than those recorded for enclosure and isolated masonry room sites. Slightly more than one-half (18 of 34, or 53%) of the isolated pit-structure sites have fewer than 26 items, and only three (9%) have none. Nine of the sites (27%) have more than 100 items, and one (3%) has more than 1,000. Not surprisingly, ceramics are particularly common, occurring at 85% (n = 29) of all sites, but debitage is also relatively common, occurring at 65% (n = 22) of the sites. Ceramics and debitage co-occur at 20 sites (59%), ceramics and ground stone at 9 (26%), ground stone and debitage at 8 (24%), and ceramics, debitage, and ground stone at 8 sites (24%). Basalt cylinders, a relatively uncommon artifact category except at the largest sites, were observed at three sites (9%).

Table 5.22 lists the results of attempts to date isolated pit-structure sites from ceramic evidence. Figure 5.18 depicts site locations.

FIGURE 5.17. Wupatki National Monument, Isolated Masonry Rooms

TABLE 5.20. Artifact Frequency Data for Isolated Pit-Structure Sites.

Missing Data	1
No Artifacts	3
1 - 10	10
11 - 25	5
26 - 100	6
101 - 500	8
501 - 1,000	0
> 1,000	1

TABLE 5.21. Representation of Artifact Classes at Isolated Pit-Structure Sites.

Ceramics	29
Debitage	22
Flaked Stone Tools	3
Ground Stone	9
Cores	1
Hammerstones	0
Hoes	4
Basalt Cylinders	3

TABLE 5.22. Periods of Occupation or Use for Isolated Pit-Structure Sites.

Period 2	1
Period 3	3
Period 4	3
Periods 3 and 4	4
Periods 4 and 5	1
Periods 2, 3, and 4	2
Undated	20

Sites with Multiple Pit Structures and No Masonry Rooms

It is somewhat questionable whether a distinction should be made between "isolated" pit-structure sites and those sites that exhibit multiple pit structures or depressions. The number of visible structures or depressions is probably not always a valid indicator of the total number of subterranean structures at the site (although in some geomorphic settings it may be), so the dichotomy between "isolated" pit-structure sites and multiple pit-structure sites, or pithouse "villages," may prove to be false. Nonetheless, recognizing again that interpretations of survey data are inherently risky, we present below the evidence from 13 sites having multiple evident pit structures or suspected structure depressions and no masonry structures.

Tables 5.23 and 5.24 provide data on the artifact assemblages from these sites. In general, artifact frequencies appear skewed toward the higher value ranges. Only two sites (15%) have fewer than 26 items, and only one (8%) has no artifacts. Eight sites (62%) have more than 100 items, and one site (8%) has more than 1,000.

Ceramics occur at 11 of the 13 sites (85%), debitage at seven (54%), and ground stone at only two (15%). Ceramics and debitage occur together at six sites (46%), ceramics and ground stone at two (15%), and ceramics, debitage, and ground stone at only one site (8%).

Table 5.25 lists the inferred periods of occupation or use for sites with multiple pit structures and no surface masonry. Figure 5.19 depicts the location of such sites.

TABLE 5.23. Artifact Frequency Data for Sites with Multiple Pit Structures and No Masonry.

Missing Data	0
No Artifacts	1
1 - 10	1
11 - 25	0
26 - 100	3
101 - 500	7
501 - 1,000	0
> 1,000	1

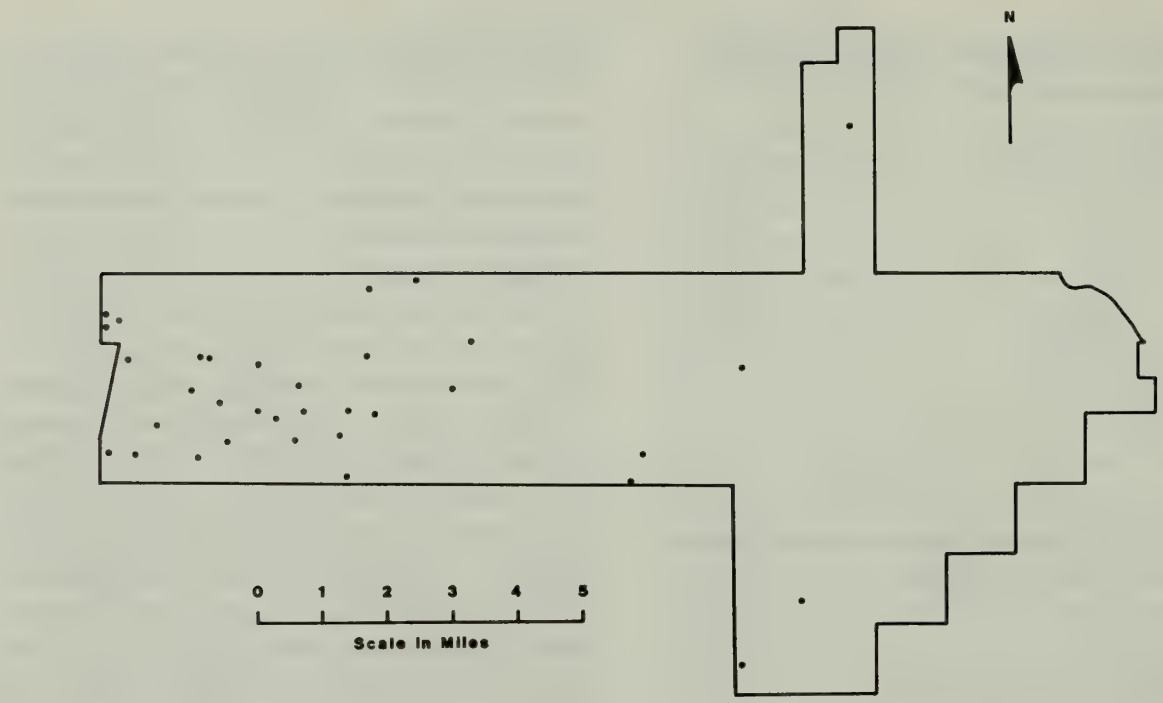


FIGURE 5.18. Wupatki National Monument, Isolated Pit Structures.

Sites with Two to Six Architectural Spaces

Table 5.26 presents the architectural attributes of the 723 sites exhibiting two to six architectural spaces. As Table 5.7 indicates, this group contains 12 sites lacking masonry structures but having from two to six evident pit structures. Compared to enclosures and single-room masonry sites, it would appear that sites with two to six architectural spaces are more elaborate and exhibit more features indicative of a possible habitation function. For example, 77 of the 711 sites with masonry architecture (nearly 11%) were estimated to have some structure present with a wall height of at least one meter. However, only two of the sites (0.3%) were believed to have upper-story rooms. Wing walls, freestanding walls, or both were present at 31% of the sites (n = 222), a proportion nearly twice as high as that recorded for single-room masonry sites and more than three times higher than that seen at enclosure sites.

TABLE 5.24. Representation of Artifact Classes at Sites with Multiple Pit Structures and No Masonry Rooms.

Ceramics	11
Debitage	7
Flaked Stone Tools	1
Ground Stone	2
Cores	3
Hammerstones	3
Hoes	1
Basalt Cylinders	0

Table 5.27 and 5.28 provide data on the frequency of artifacts and the representation of major artifact categories observed at all sites with two to six architectural spaces. In terms of artifact frequency, cases appear more evenly distributed among the various categories than for other site groupings. Furthermore, the

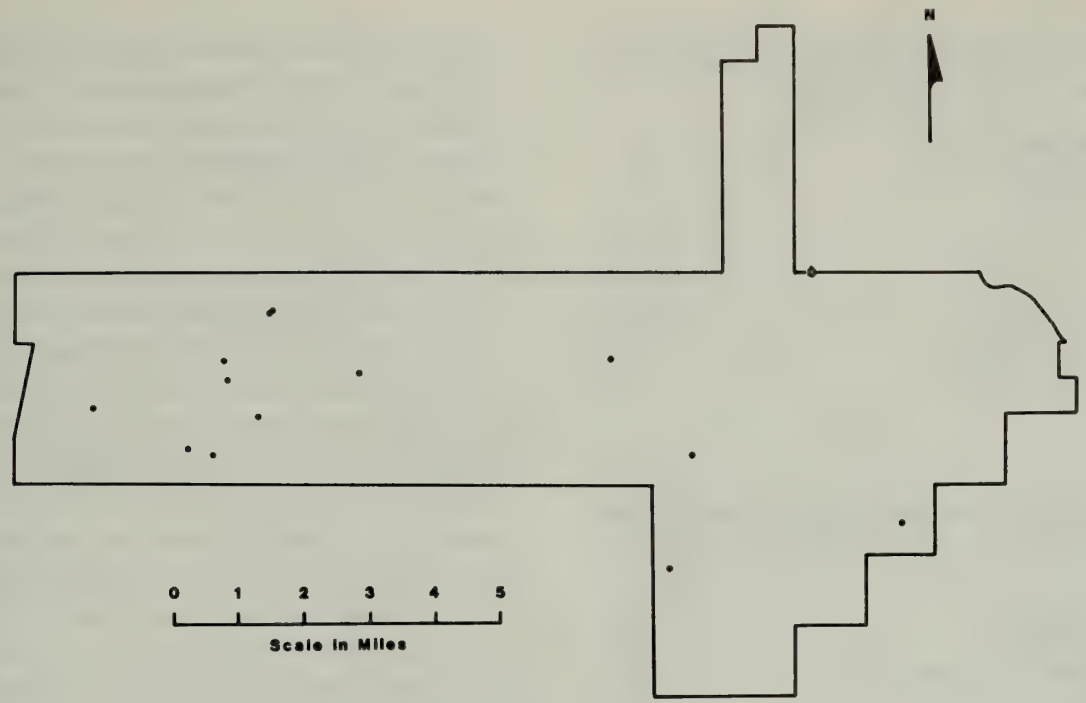


FIGURE 5.19. Wupatki National Monument, Sites with Multiple Pit Structures, No Masonry Rooms.

TABLE 5.25. Periods of Occupation or Use for Sites with Multiple Pit Structures and No Masonry Rooms.

Period 2	1
Period 4	3
Periods 2 and 4	1
Periods 3 and 4	2
Periods 2, 3, 4, and 5	1
Undated	5

proportion of sites having very few or no surface artifacts is greatly reduced when compared to the groupings of enclosures, isolated masonry rooms, and pit-structure sites. Of 709 sites for which artifact frequency was recorded, 279 (39%) had fewer than 26 surface artifacts and only 24 (3%) had none. Nearly 28% of the sites (n = 198) were categorized as having more than 100 surface artifacts, and nearly 3% (n = 19) were thought have more than 1,000.

Major artifact categories were also relatively more common. Ceramics were present at 95% (n =688) of all sites, debitage at nearly 75% (n = 539), and ground stone at approximately 31% (n = 223). Ceramics and debitage co-occur at

TABLE 5.26. Architectural Data for Sites with Two to Six Architectural Spaces.

Wall Height > 1 meter	77
Upper-Story Rooms Present	2
Bedrock in Wall	219
Wing Wall Present	135
Freestanding Wall Present	57
Wing and Freestanding Walls Present	30
Basalt Primary Building Material	358
Limestone Primary Building Material	221
Sandstone Primary Building Material	90
Mixed, No Dominant Building Material	37
Missing Data on Building Material	5
No Masonry Present	12

TABLE 5.27. Artifact Frequency Data for Sites with Two to Six Architectural Spaces.

Missing Data	14
No Artifacts	24
1 - 10	122
11 - 25	133
26 - 100	232
101 - 500	146
501 - 1,000	33
> 1,000	19

TABLE 5.28. Representation of Artifact Classes at Sites with Two to Six Architectural Spaces.

Ceramics	688
Debitage	539
Flaked Stone Tools	127
Ground Stone	223
Cores	79
Hammerstones	55
Hoes	62
Basalt Cylinders	15

529 sites (73%), ceramics and ground stone at 221 sites (31%), ground stone and debitage at 196 (27%), and ceramics, debitage, and ground stone at 194 sites (27%).

Table 5.29 lists the inferred periods of occupation or use for all sites with two to six architectural spaces. Figure 5.20 shows site locations.

Sites with Seven to 10 Architectural Spaces

Table 5.30 presents architectural data for the 68 sites having from seven to 10 architectural spaces. As shown in Table 5.7, only one of these sites--a site with 10 depressions--completely lacks masonry rooms. The table clearly shows a strong divergence of sites in this category from those having fewer than seven architectural spaces. Of the 67 sites having from seven to 10 architectural spaces and surface masonry rooms, 38, or nearly 57%, have some structure with an estimated wall height of at least one meter and eight (12%) are believed to have a structure with more than one story. More than 55% (n = 37) of the sites with surface masonry have some extramural elaboration in the form of wing walls, freestanding walls, or both. There are also striking differences in building materials. Sandstone, a relatively uncommon building material in smaller sites, is the most common dominant material in sites with seven to ten architectural spaces (27, or 66 valid cases, or 41%).

Surface artifact frequencies (Table 5.31) also show divergence from the patterns observed at smaller sites. None of the 68 sites with seven to 10 architectural spaces has fewer than 11 items. Only four sites have fewer than 26 surface artifacts, and a large majority (83%, or 55 of 66 valid cases) have more than 100. Fully 30% (20 of 66) of the sites were judged to have more than 1,000 surface items.

With respect to major artifact categories (Table 5.32), every site has

TABLE 5.29. Periods of Occupation or Use for Sites with Two to Six Architectural Spaces.

Period 2	7
Period 3	44
Period 4	158
Period 5	11
Periods 2 and 3	4
Periods 2 and 4	10
Periods 2 and 5	3
Periods 3 and 4	94
Periods 3 and 5	2
Periods 4 and 5	34
Periods 2, 3, and 4	24
Periods 2, 4, and 5	4
Periods 3, 4, and 5	36
Periods 2, 3, 4, and 5	17
Undated	275

FIGURE 5.20. Wupatki National Monument, Sites wi57 2 to 6 Architectural Spaces.

ceramics and nearly 96% (n = 65) have debitage. Ground stone is also relatively common, occurring at more than two-thirds (46, or 68%) of all sites. Co-occurrences of artifact categories that cannot be deduced from Table 5.32 are as follows: debitage and ground stone occur at 44 sites (65%), as does the combination of debitage, ground stone, ceramics.

TABLE 5.30. Architectural Data for Sites with Seven to 10 Architectural Spaces.

Wall Height > 1 meter	38
Upper-Story Rooms Present	8
Bedrock in Wall	11
Wing Wall Present	22
Freestanding Wall Present	8
Wing and Freestanding Walls Present	7
Basalt Primary Building Material	20
Limestone Primary Building Material	14
Sandstone Primary Building Material	27
Mixed, No Building Material Dominant	5
Missing Data on Building Material	1
No Masonry Present	1

TABLE 5.31. Artifact Frequency Data for Sites with Seven to 10 Architectural Spaces.

Missing Data	2
No Artifacts	0
1 - 10	0
11 - 25	4
26 - 100	7
101 - 500	21
501 - 1,000	14
> 1,000	20

Table 5.33 lists the results of attempts to date sites with seven to 10 architectural spaces from ceramic evidence. As the table shows, all but 4 of the 68 sites (6%) could be assigned to one or more periods, with the majority (44, or 69%) fitting some combination of two, three, or four periods. Figure 5.21 depicts the locations of all prehistoric

sites having from seven to 10 architectural spaces.

Sites with 11 to 20 Architectural-Spaces

Table 5.34 lists the architectural attributes of the 40 sites with 11 to 20 architectural spaces. All sites have at least one masonry structure, and, as shown in Table 5.7, ten of the sites are accompanied by from one to four pit structures. In general, the sites seem well-suited for habitation. Thirty-three sites (83%) were judged to have some masonry structure with a wall height of at least one meter, and 14 (35%) appear to have upper-story rooms. Extramural constructions, in the form of wing walls, freestanding walls, or both, are present at nearly 58% of the sites (n = 23). As with the sites having from seven to 10 architectural spaces, sandstone was evidently a particularly popular construction material, forming the dominant material type at 14 sites (35%).

The frequency of artifacts and the representation of artifact classes (Tables 5.35 and 5.36) also appear to support an inferred

TABLE 5.32. Representation of Artifact Classes at Sites with Seven to 10 Architectural Spaces.

Ceramics	68
Debitage	65
Flaked Stone Tools	23
Ground Stone	46
Cores	24
Hammerstones	13
Hoes	3
Basalt Cylinders	4

TABLE 5.33. Periods of Occupation or Use for Sites with Seven to 10 Architectural Spaces.

Period 2	3
Period 3	3
Period 4	13
Period 5	1
Periods 2 and 4	2
Periods 3 and 4	7
Periods 4 and 5	10
Periods 2, 3, and 4	5
Periods 2, 4, and 5	1
Periods 3, 4, and 5	12
Periods 2, 3, 4, and 5	7
Undated	4

TABLE 5.34. Architectural Data for Sites with 11 to 20 Architectural Spaces.

Wall Height > 1 meter	33
Upper-Story Rooms Present	14
Bedrock in Wall	4
Wing Wall Present	14
Freestanding Wall Present	5
Wing and Freestanding Walls Present	10
Basalt Primary Building Material	8
Limestone Primary Building Material	10
Sandstone Primary Building Material	14
Mixed, No Dominant Building Material	8
Missing Data on Building Material	0
No Masonry Present	0

TABLE 5.35. Artifact Frequency Data for Sites with 11 to 20 Architectural Spaces.

Missing Data	1
No Artifacts	0
1 - 10	1
11 - 25	2
26 - 100	2
101 - 500	12
501 - 1,000	10
> 1,000	12

habitation function for sites with 11 to 20 architectural spaces. Of 39 sites having an estimate of artifact frequency, only five (13%) have fewer than 100 items, and a majority (22, or 56%) have more than 500. Ceramics are present at every site, debitage at 38 (95%), and ground stone at 23 sites (58%). Ceramics, debitage, and ground stone occur at 23 sites (58%).

Table 5.37 lists the inferred periods of occupation or use for sites with 11 to 20 architectural spaces. As that table shows, only two sites (5%) could not be dated, and most of the remainder (34, or 85%) were placed in two to four time periods. Figure 5.21 depicts site locations.

TABLE 5.36. Representation of Artifact Classes at Sites with 11 to 20 Architectural Spaces.

Ceramics	40
Debitage	38
Flaked Stone Tools	17
Ground Stone	23
Cores	12
Hammerstones	7
Hoes	1
Basalt Cylinders	3

TABLE 5.37. Periods of Occupation or Use for Sites with 11 to 20 Architectural Spaces.

Period 4	4
Periods 2 and 4	2
Periods 3 and 4	9
Periods 4 and 5	5
Periods 2, 3, and 4	5
Periods 3, 4, and 5	8
Periods 2, 3, 4, and 5	5
Undated	2

Sites with More than 20 Architectural Spaces

Sites with more than 20 architectural spaces represent the ten largest sites at Wupatki National Monument. These sites are, in descending order of size, Wupatki Pueblo (WS 9991; NA 405), 102 spaces; the Citadel (WS 9993; NA 355), 51 spaces; the Campground Ruin (WS1494; NA 2222) 33 spaces; WS 890, an unnamed ruin near the south boundary of the Monument just north of Arrowhead Tank, 25 spaces; WS 1636 (NA 373), an unnamed ruin on East Mesa, 25 spaces; WS 1723 (NA 352), an unnamed ruin on Middle Mesa, 24 spaces; WS 834, a set of widely scattered masonry structures on Horseshoe Mesa, 23 spaces; WS 142 (NA 2839), a set of masonry structures at the base of Citadel Mesa, 22 spaces; Crack-in-Rock Pueblo (NA 537), 22 spaces; and WS 1556 (NA 656), an unnamed ruin on North Mesa, 22 spaces.

Table 5.38 lists the architectural attributes of these sites. With the exception of WS 142, a site that may consist mainly of partially subterranean structures, all sites were judged to have a wall height of at least one meter, and half were thought to have upper-story rooms. Eight of the ten sites had extramural constructions in the form of both wing and freestanding walls. Clearly, the preferred building material for the

TABLE 5.38. Architectural Data for Sites with 20 Architectural Spaces.

Wall Height > 1 meter	9
Upper-Story Rooms Present	5
Bedrock in Wall	1
Wing Wall Present	0
Freestanding Wall Present	0
Wing and Freestanding Walls Present	8
Basalt Primary Building Material	1
Limestone Primary Building Material	0
Sandstone Primary Building Material	6
Mixed, No Material Dominant	3
Missing Data on Building Material	0
No Masonry Present	0

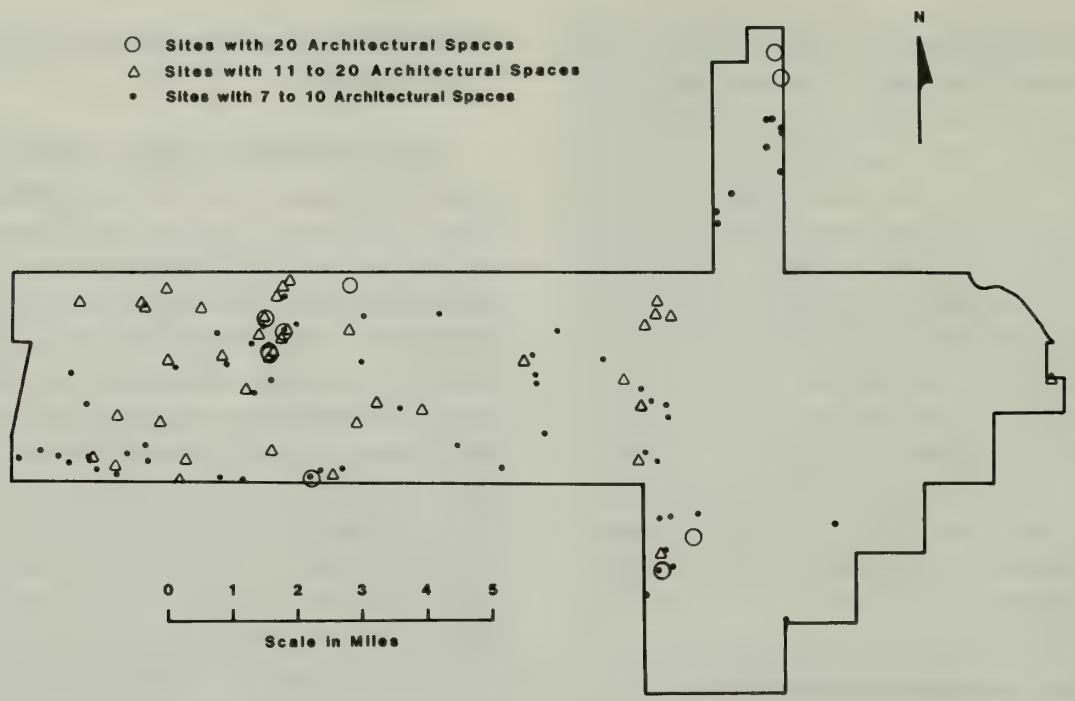


FIGURE 5.21. Wupatki National Monument, Distribution of Sites with 6 Architectural Spaces.

largest sites was sandstone, which was dominant at six sites and present in the rest, either as a minor component (at WS 142, built primarily of basalt) or as a substantial component at the three sites where "mixed" materials were used.

The frequency of artifacts (Table 5.39) is skewed toward the highest values. No site appeared to have fewer than 100 surface items, and 70% were judged to have more than 1,000. In spite of the fact that many of the sites are quite close to access roads and visitors' trails, ceramics and debitage were observed at every site and ground stone was seen at six (Table 5.40).

Table 5.41 lists the inferred periods of occupation or use for all sites with more than 20 architectural spaces. As the table shows, all sites could be placed in one or more temporal periods. Only a single site (again, WS 142) could be placed in only a single component. The remainder showed evidence of occupation or use during two, three, or four periods.

Figure 5.21 shows the distribution of all sites with more than 20 architectural spaces.

Summary and Conclusions

This chapter has provided basic descriptive data on the prehistoric sites of Wupatki

TABLE 5.39. Artifact Frequency Data for Sites with 20 Architectural Spaces.

Missing Data	0
No Artifacts	0
1 - 10	0
11 - 25	0
26 - 100	0
101 - 500	2
501 - 1,000	1
> 1,000	7

TABLE 5.40. Representation of Artifact Classes at Sites with 20 Architectural Spaces.

Ceramics	10
Debitage	10
Flaked Stone Tools	6
Ground Stone	6
Cores	5
Hammerstones	3
Hoes	2
Basalt Cylinders	3

TABLE 5.41. Periods of Occupation or Use for Sites with 20 Architectural Spaces.

Period 4	1
Periods 2 and 3	1
Periods 3 and 4	4
Periods 3, 4, and 5	2
Periods 2, 3, 4, and 5	2
Undated	0

National Monument. Ten basic types of sites have been proposed and described: artifact scatters; agricultural sites; reservoirs; cist sites; building-stone quarries; shrines; petroglyph sites; burial sites; isolated artifacts of special significance; and sites with architectural remains.

The last category is by far the most abundant, accounting for more than 92% of all prehistoric sites. Among sites with architectural remains, several subdivisions were proposed, based on the presence or absence of masonry rooms and overall size: enclosure sites; isolated masonry rooms; isolated pit structures; sites with multiple pit structures and no masonry rooms; sites with two to six architectural spaces; sites with seven to 10 architectural spaces; sites with 11 to 20 architectural spaces; and sites with more than 20 architectural spaces. The artifact assemblages, formal attributes, dates, and spatial distributions of these categories were described.

Throughout the chapter, we have refrained from detailed discussion of possible site functions and seasons of occupation. These issues will be dealt with in more detail in the Chapter where we propose a tentative functional typology of prehistoric Wupatki sites.

A Preliminary Consideration of Undecorated Ceramic Assemblages

As in other areas of the Southwest, a traditional method of addressing the issue of prehistoric ethnic or tribal affiliations in the Flagstaff area has been through examination of undecorated ceramic assemblages. The development of this methodology has a very long history, extending back to the period immediately following the First World War, when systematic spatial variation in undecorated assemblages was first described (Colton 1926). The zone now encompassed by Wupatki National Monument has often been at the forefront of emerging methods and interpretations, and generations of Flagstaff archaeologists have struggled to assign ethnic or tribal labels and boundaries to the complex patterns of material culture that exist there (Colton 1946, 1968; Fewkes 1900, 1904a, 1904b; King 1949; Powell 1891; Reed 1939; Smith 1952; Stanislawski 1963). At present, however, the meaning of these patterns remains elusive, and a number of possible explanations--including successive and non-overlapping occupations of individual sites by different ethnic or tribal groups, simultaneous occupations by the same groups, or complex patterns of exchange--cannot yet be excluded.

In this section, we attempt little more than a preliminary consideration of the composition and spatial distribution of Wupatki-area ceramic assemblages. We do not propose to resolve difficult questions regarding the social or cultural meaning of these distributions. Such questions must await future studies that might clarify related issues in chronology, ceramic manufacture and exchange, and the role of ceramics in larger systems of material culture and behavior.

The remainder of the section is organized as follows. First, we provide the percentage breakdowns of four major wares found on Wupatki National Monument--Tusayan, San Francisco Mountain, and Prescott gray wares and Alameda Brown Ware--for those sites having both quantitative ceramic assemblage data and a sample of more than 30 undecorated sherds. Next, undecorated assemblages from a much larger sample of sites are examined by means of a cluster analysis that groups assemblages into seven categories based on the percentage values of the four major wares. Results of the two methods are compared, and the characteristics and spatial distribution of undecorated assemblages are summarized.

Percentage Breakdowns of Undecorated Assemblages

Probably the simplest means of examining the distribution of prehistoric ceramic assemblages at Wupatki National Monument is through a consideration of the percentage values of the major ceramic wares at individual sites. In the following presentation, only the undecorated (i.e., unpainted) types within each ware are considered, percentages referring to the contribution that each ware makes to the total undecorated assemblage rather than to the percentage of the ceramic assemblage as a whole. To minimize interpretive errors that might be caused by small samples of sherds or biased collection techniques, some restrictions have been applied to the data. All assemblages considered here have at least 30 undecorated sherds, and all data were derived either through excavation, systematic surface collection, or a complete or systematic field inventory of surface ceramics (i.e., ceramic data types 1, 2, or 3; see The Data Base, above). A total of 299 sites was found suitable for analysis under these criteria.

Tusayan Gray Ware

Figure 5.22 provides a histogram of site frequencies for Tusayan Gray Ware percentages, broken down by 20% increments. As that figure shows, site frequencies increase steadily with increases in the percentage values of Tusayan Gray Ware. Only 15 of 299 sites analyzed (5%) have values of 20% or less, while 252 (84%) have values of more the 40%. Nearly two-thirds of all sites (196, or 66%) have more than 60% Tusayan Gray Ware in their undecorated assemblages, and 116 sites (nearly 39%) have more than 80%.

Figures 5.23 and 5.24 graphically illustrate the dominance of Tusayan Gray Ware in the ceramic assemblages of prehistoric sites at Wupatki National Monument. Figure 5.23 depicts the distribution of sites (n =222, or 74%) for which Tusayan Gray Ware constitutes the dominant undecorated ware, i.e., the percentage of Tusayan Gray Ware is at least 50%. There seems to be little apparent clustering of these sites by region. Generally, the distribution of the sites follows the distribution of all prehistoric sites across the Monument. It should be noted that apparent gaps in site distribu-

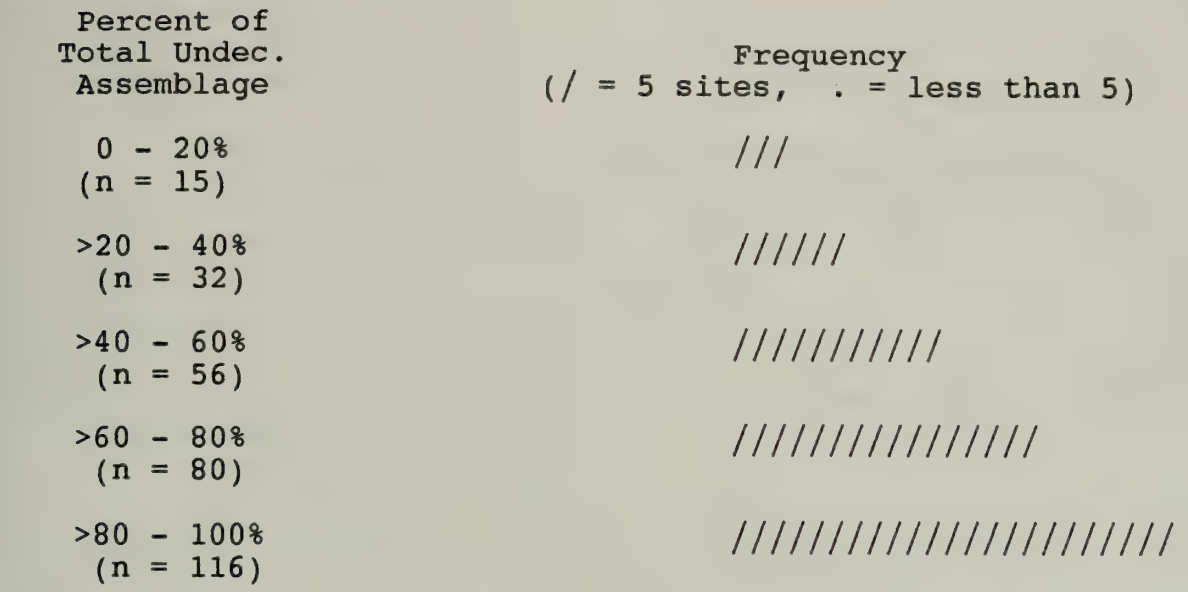


FIGURE 5.22. Histogram of Tusayan Gray Ware Percentages at Sites with Systematic Sherd Collections and Total Undecorated Sherds ≥ 30.

tions in the extreme northern and northeastern corners of the Monument reflect generally low site densities in these zones (Figure 5.6), and that a lack of sites in the southern end of the Monument indicates only that no sites fitting the data requirements occur in this area.

Figure 5.24 shows much the same pattern for sites having at least 75% Tusayan Gray Ware. Although the total number of sites (n = 149, or 50%) is less than the total of sites having more than 50% Tusayan Gray Ware, there again seems to be no apparent confinement of such sites to a particular zone. Sites with 75% or more Tusayan Gray Ware occur in all zones of the Monument, including the Wupatki Basin.

Alameda Brown Ware

Figure 5.25 is a histogram of percentage values for Alameda Brown Ware. As that figure shows, for a large majority of sites (n = 208, or nearly 70%), Alameda Brown Ware does not exceed 20% of the total undecorated assemblage. Fifty sites (17%) have between 20% and 40% Alameda Brown Ware, and only 22 sites (7%) have from 40% to 60%. Just seven sites (2%) have more than 80% Alameda Brown Ware.

Figures 5.26 and 5.27 show the distributions of sites with more than 50% (n = 26, or 9%) and more than 75% (n = 9, or 3%) Alameda Brown Ware, respectively. Generally, sites with more than 50% Alameda Brown Ware are clustered in two areas: around Wupatki Pueblo, and in a broad band extending along the middle south portion of the Monument. Sites having at least 75% Alameda Brown Ware are confined exclusively to these zones.

San Francisco Mountain Gray Ware

Figure 5.28 provides a histogram of site frequencies for 20% increments of San Francisco Mountain Gray Ware. For nearly four-fifths of the sites considered (n = 233,

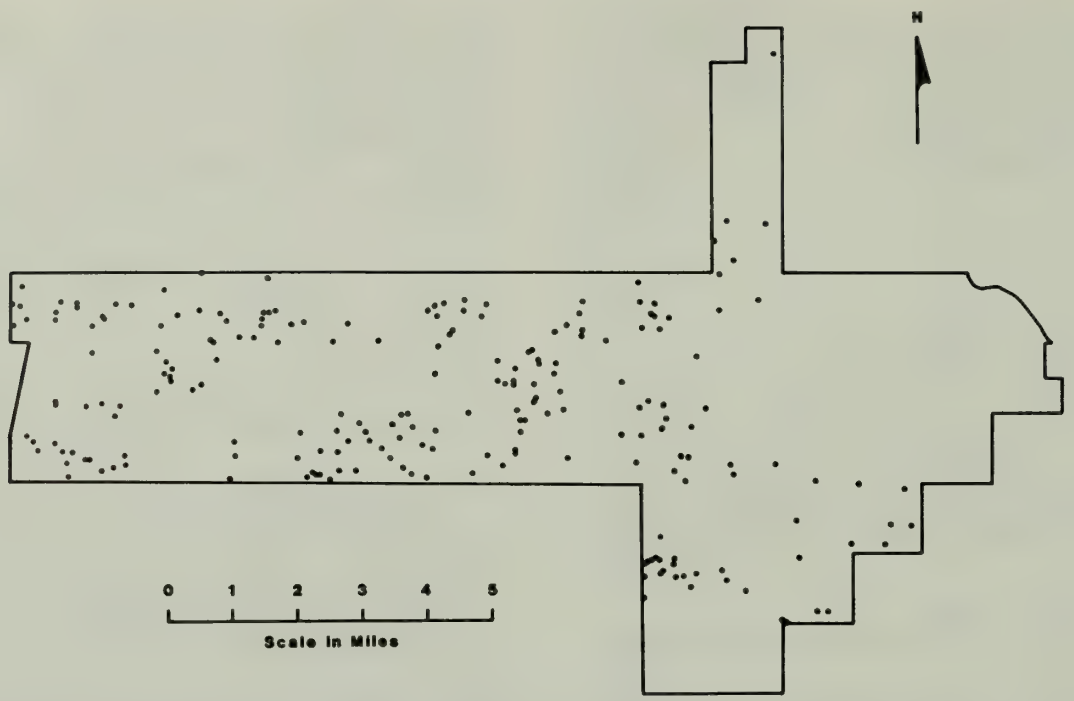


FIGURE 5.23. Wupatki National Monument, Sites with 50% Tusayan Gray Ware ≥ 30 Undecorated Sherds.

FIGURE 5.24. Wupatki National Monument, Sites with 75% Tusayan Gray Ware ≥ 30 Undecorated Sherds.

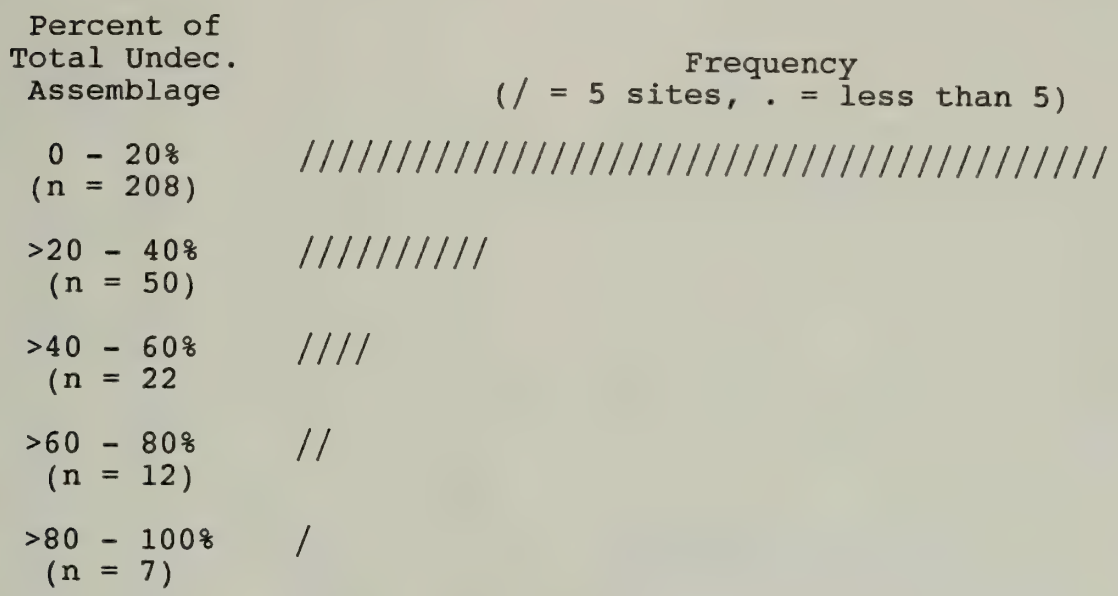


FIGURE 5.25. Histogram of Alameda Brown Ware Percentages at Sites with Systematic Collections and Total Undecorated Sherds ≥ 30.

or 78%), this ware constitutes no more than 20% of the undecorated ceramic assemblage. Twenty-seven sites (9%) have from 20% to 40% San Francisco Mountain Gray Ware, and 31 (10%) have from 40% to 60%. Only two sites (0.7%) have more than 80% of this ware.

Figure 5.29 depicts the locations of sites for which San Francisco Mountain Gray Ware constitutes at least 50% of the undecorated assemblage (n = 23, or 8%), and Figure 5.30 shows those sites where percentage values are at least 75% (n =3, or 1%). Both figures reveal a pronounced clustering of sites in the far western portion of the Monument and a complete lack of sites in any other portion of the Monument.

Prescott Gray Ware

Figure 5.31 is a histogram of site frequencies for 20% increments of Prescott Gray Ware. Obviously, for the overwhelming majority of sites Prescott Gray Ware is only a minor component of the undecorated assemblage. At more than 98% of the sites (n = 294), Prescott Gray Ware constitutes 20% or less of the undecorated sherds. Only five sites (less than 2%) have more than 20% Prescott Gray Ware, and no site has more than 50%.

Sites with "Mixed" Undecorated Assemblages

Twenty-eight of the 299 analyzed sites (9%) have sherd assemblages that are not dominated by any of the four major wares, i.e., no single ware exceeds 50% of the total undecorated assemblage. These sites are here considered to have "mixed" assemblages. Although many other arbitrary criteria can and in fact have been invoked as indices of mixed ceramic assemblages (e.g., Colton 1946:36), it seems reasonable to propose that sites lacking a dominant ware should be considered ceramically mixed by almost any definition.

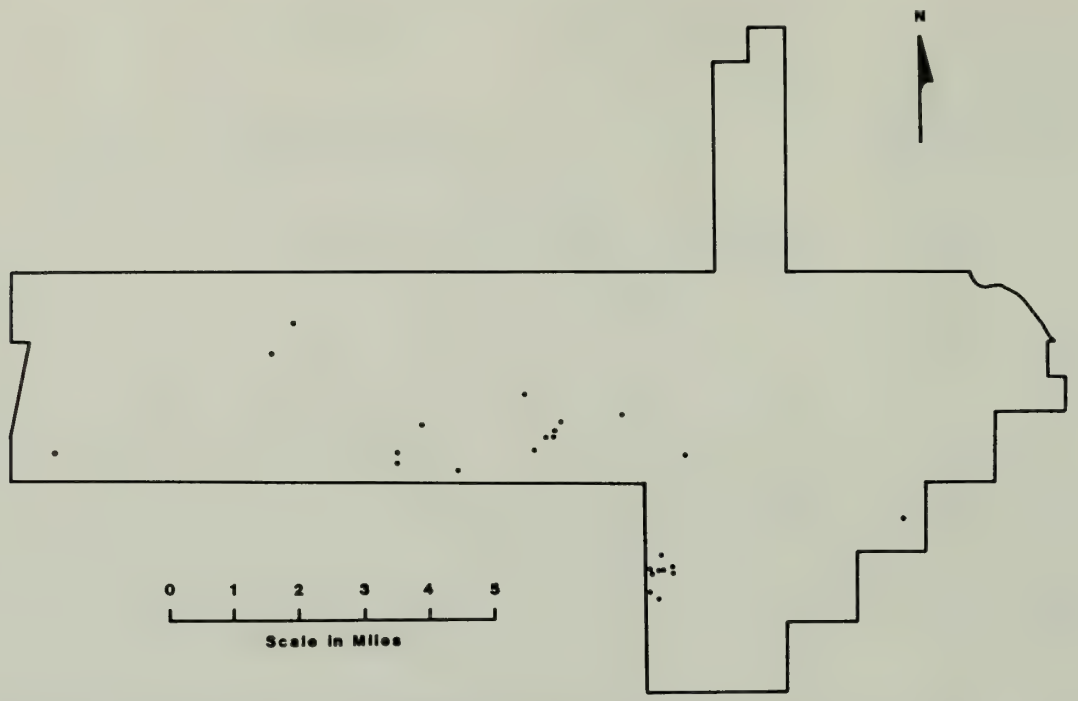


FIGURE 5.26. Wupatki National Monument, Sites with 50% Alameda Brown Ware ≥ 30 Undecorated Sherds.

FIGURE 5.27. Wupatki National Monument, Sites with 75% Alameda Brown Ware ≥ 30 Undecorated Sherds.

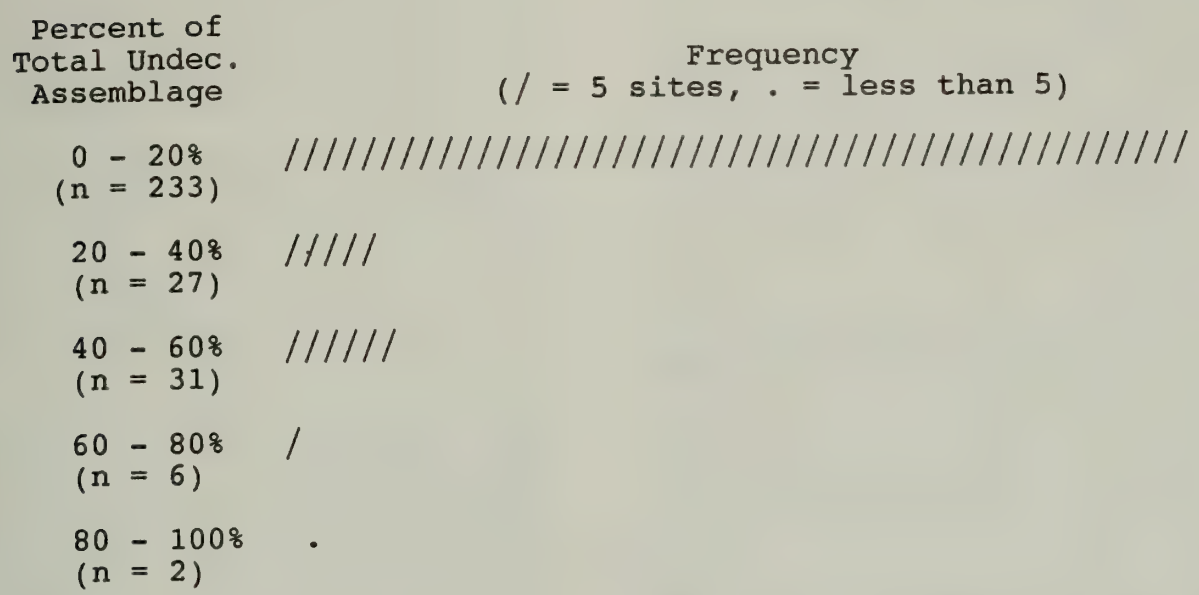


FIGURE 5.28. Histogram of Percentages of San Francisco Mountain Gray Ware at Sites with Systematic Collections and Total Undecorated Sherds ≥ 30.

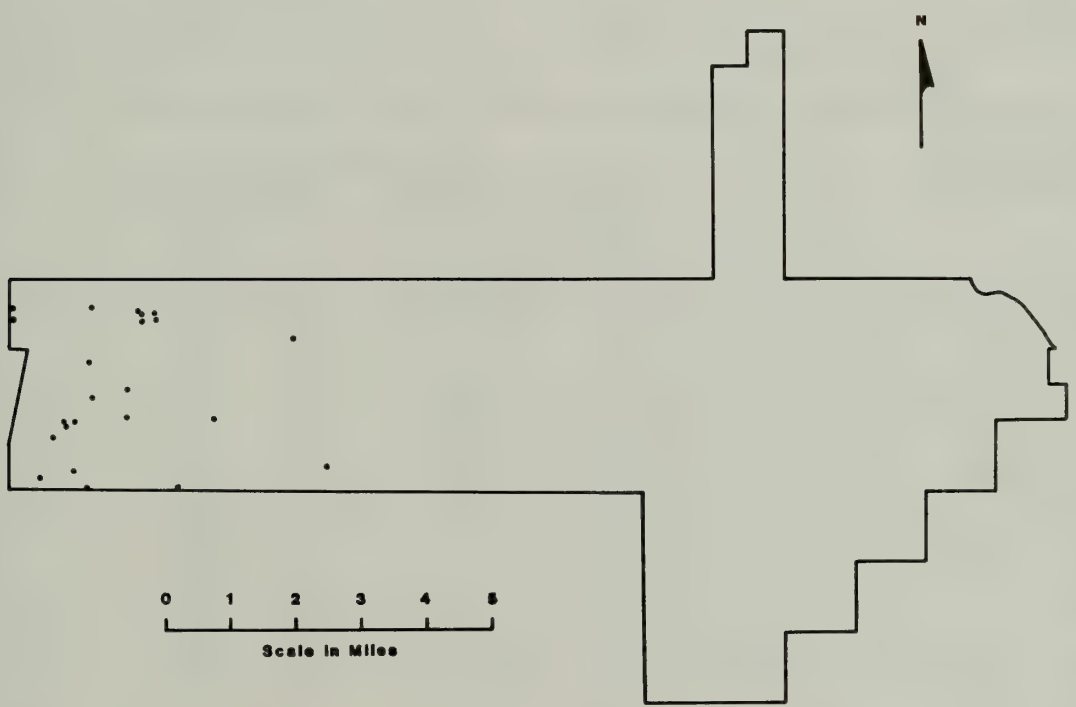


FIGURE 5.29. Wupatki National Monument, Sites with 50% S.F. Mntn. Gray Ware ≥ 30 Undecorated Sherds.

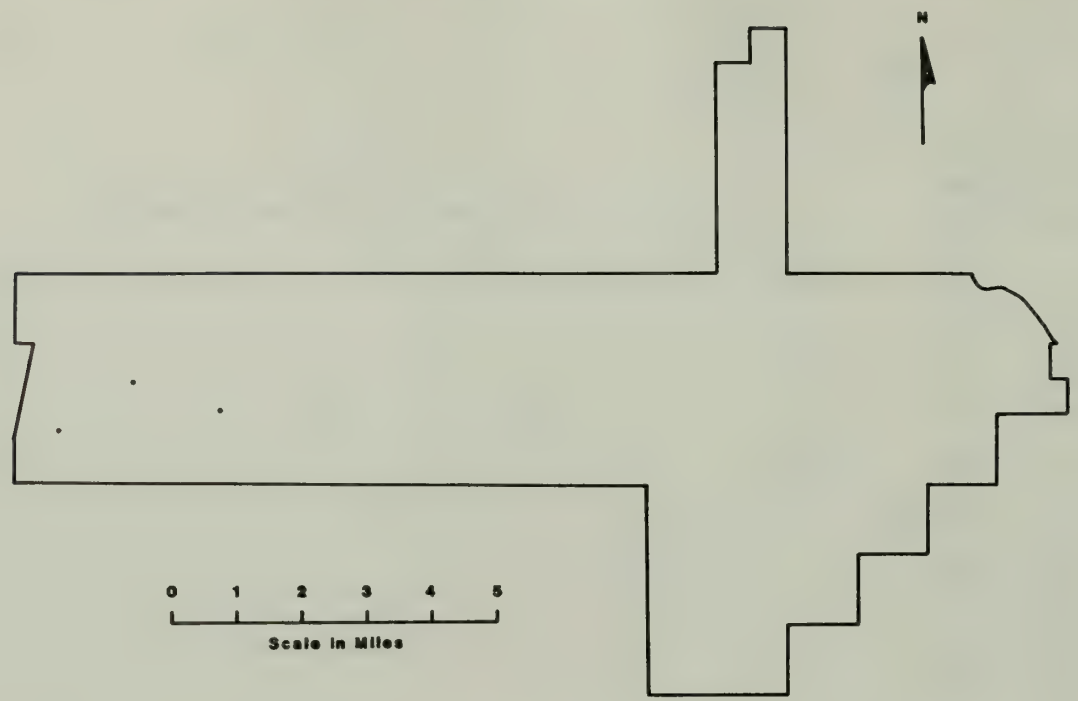


FIGURE 5.30. Wupatki National Monument, Sites with 75% S.F. Mntn. Gray Ware ≥ 30 Undecorated Sherds.

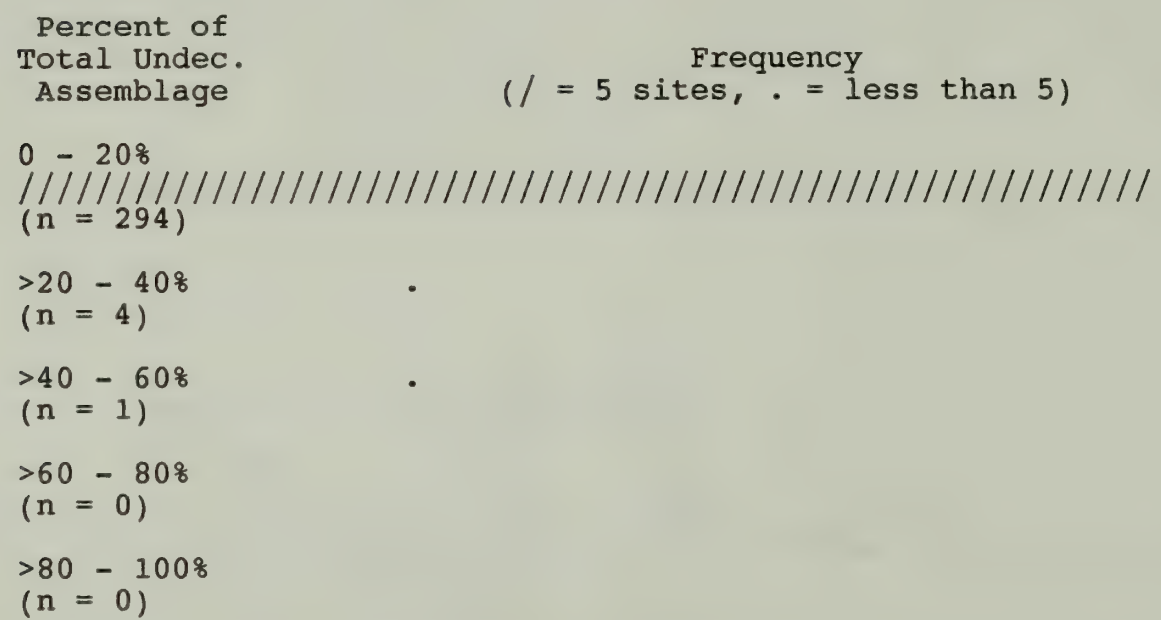


FIGURE 5.31. Histogram of Percentages of Prescott Gray Ware at Sites with Systematic Collections and Total Undecorated Sherds ≥30.

Table 5.42 provides information on the attributes of the 28 sites that lack a dominant undecorated ware. As that table shows, all but two of the sites have at least one architectural space, but none is a particularly large site. A great majority of the sites (n = 20, or 71%) have from one to three spaces, and the largest has only eight. Reflecting the fact that the sites themselves are usually small, sherd sample sizes are also relatively small. Only six sites (21%) have samples of more than 100 sherds, and only two (7%) exceed 200.

Several trends are apparent in Table 5.42 with respect to the ware compositions of mixed assemblages. First, as with the 271 sites having non-mixed assemblages, Tysayan Gray Ware is relatively common; it is present at every site, and is usually represented in quantities of 40% or more (n = 20, or 71%). Only two sites (7%) have less than 30% Tusayan Gray Ware. Second, as is also the case at sites with less ambiguous undecorated assemblages, Prescott Gray Ware is relatively uncommon. This ware is completely lacking at 21 of the 28 sites (75%), and is represented in quantities of 10% or more at only four sites (14%). No site has more than 30% Prescott Gray Ware. Third, San Francisco Mountain Gray Ware is nearly always strongly represented at sites with mixed assemblages. Although one site completely lacks this ware and five have less than 20%, 20 sites (71%) have more the 30% San Francisco Mountain Gray Ware and 13 (46%) have more than 40%. Finally, Alameda Brown Ware is perhaps the most erratically distributed of the four wares. No site is completely lacking in Alameda Brown Ware, but seven sites (25%) have less than 10% and 17 sites (61%) have 20% or less. The ware is abundant at some sites, however, as seven (25% have 30% or more, and three sites (11%) have more than 40%.

Several ware combinations are noteworthy. Sites having a strong representation of both Tusayan and San Francisco Mountain Gray Wares appear to be par-

TABLE 5.42. Attributes of Sites with "Mixed" Ceramic Assemblages and ≥ 30 Undecorated Sherds.

1	2	3	4	5	6	7	8	9	10	11	12
458	4	36	2	47.22	5.56	44.44	2.78	0	1	0	0
463	8	2650	3	48.23	4.30	46.57	0.57	0	1	1	1
546	7	41	2	48.78	14.63	36.59	0.00	0	0	1	0
966	3	34	1	47.06	20.59	32.35	0.00	0	0	1	0
985	2	33	1	45.45	18.28	21.21	0.00	0	0	0	0
994	2	33	1	45.45	24.24	30.30	0.00	0	0	1	0
1162	2	45	1	37.78	2.22	37.78	22.22	0	0	0	0
1169	2	55	1	34.55	7.27	41.82	16.36	0	1	0	0
1280	1	30	1	36.67	20.00	43.33	0.00	0	0	0	0
1283	3	108	1	47.22	10.19	42.59	0.00	0	1	1	0
1332	1	32	1	40.63	12.50	43.75	0.00	0	1	0	0
1887	1	35	1	42.86	20.00	37.14	0.00	0	1	1	0
1942	2	75	1	33.33	33.33	33.33	0.00	0	0	0	0
2025	1	74	1	45.95	45.95	8.11	0.00	1	1	0	0
2028	0	39	1	48.72	43.59	7.69	0.00	1	0	1	1
2131	4	278	1	49.64	18.35	2.52	29.50	1	1	1	1
2132	3	58	1	37.93	5.17	17.24	0.00	1	0	1	0
2266	1	85	1	35.29	23.53	41.18	0.00	0	1	0	0
2286	7	121	1	47.11	48.76	0.00	0.00	0	1	1	0
2453	2	100	1	45.00	22.00	30.00	3.00	0	0	1	0
2479	3	96	1	44.79	10.42	44.79	0.00	0	1	1	0
2480	3	92	1	47.83	7.61	44.57	0.00	0	0	0	0
2487	0	52	1	40.38	15.38	44.23	0.00	0	1	0	0
2528	1	65	1	29.23	13.85	46.15	10.77	0	1	1	0
2532	4	165	1	24.85	34.55	40.61	0.00	0	1	1	1
2618	3	31	1	41.94	32.26	25.81	0.00	0	1	1	0
2635	1	34	1	44.12	38.24	17.65	0.00	0	0	0	0
2638	2	45	1	48.89	6.67	44.44	0.00	0	1	0	0

Key to column headings: 1 = WS site number; 2 = number of architectural spaces; 3 = total number of undecorated sherds; 4 = ceramic collection type (see The Data Base, above, for codes); 5 = percent Tusayan Gray Ware; 6 = percent Alameda Brown Ware; 7 percent San Francisco Mountain Gray Ware; 8 = percent Prescott Gray Ware; 9 = Period 2 (1 = yes, 0 = no); 10 = Period 3; 11 = Period 4; 12 = Period 5.

ticularly common. Eighteen sites (64%) have at least 30% of both wares represented in their undecorated assemblages, and eight sites (29%) have at least 40% of both. Six sites (21%) have a combination of at least 30% Alameda Brown Ware and at least 30% Tusayan Gray Ware, and three (11%) have at least 40% of both wares. Other combinations are much less frequent. Only two sites (7%) have a minimum of 30% Alameda Brown Ware and 30% San Francisco Mountain Gray Ware, and one of these sites also has at least 30% Tusayan Gray Ware. The most diverse assemblage is found at site WS 2528, which has at least 10% of all four major wares.

Twenty-two of the 28 sires (82%) could be ceramically dated to one or more periods. Most of the dated sites (12, or 55%) were dated to multiple periods. It would appear that sites with mixed ceramic assemblages tend to date somewhat earlier than the general population of dated sites at Wupatki National Monument. A total of 39 periods was assigned to the 28 mixed sites. Four of the assignments (10.3%) were to Period 2, 16 (41.0%) to Period 3, 15 (38.5%) to Period 4, and four (10.3%) to Period 5. These figures may be compared to those derived for all dated sites on the Monument (see Chronology, above). For all sites, 1,627 components were identified, of which two (.1%) were Period 1; 147 (9.4%) were Period 2; 461 (28.3%) were Period 3; 809 (49.7%) were Period 4; and 208 (12.8%) were Period 5.

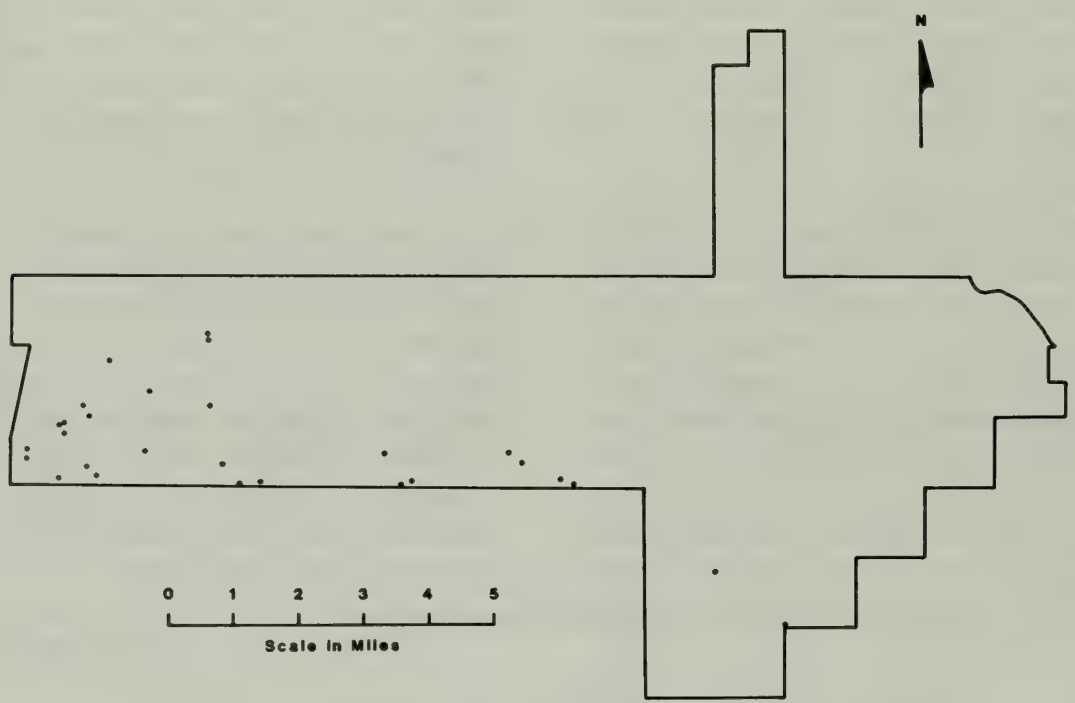


FIGURE 5.32. Wupatki National Monument, Sites with "mixed" Ceramic Assemblages ≥ 30 Undecorated Sherds.

Figure 5.32 depicts the locations of sites with mixed ceramic assemblages. Most of the sites appear to be concentrated in the far western portion of the Monument, with the remainder strung out along the south boundary. Two sites are located in the Wupatki Basin.

Key to column headings: 1 = WS site number; 2 = number of architectural spaces; 3 = total number of undecorated sherds; 4 = ceramic collection type (see The Data Base, above, for codes); 5 = percent Tusayan Gray Ware; 6 = percent Alameda Brown Ware; 7 percent San Francisco Mountain Gray Ware; 8 = percent Prescott Gray Ware; 9 = Period 2 (1 = yes, 0 = no); 10 = Period 3; 11 = Period 4;
12 = Period 5.

Cluster Analysis of Undecorated Assemblages

In the preceding section, undecorated ceramic assemblages were examined in terms of arbitrarily selected percentage criteria. We recognize, however, that use of such cutoff figures can conceal natural patterns of variability. In the following analysis, therefore, we use a multivariate statistical technique to guide the process of grouping ceramic assemblages. The technique is a hierarchical agglomerative cluster analysis, called QUICK CLUSTER for SPSS/PC+ (Norusis 1988), that produces a preselected number of clusters for a given "grouping" problem.

For the purposes of this analysis, we will adopt the nomenclature of traditional prehistoric culture units (Colton 1939, 1946; King 1949; Smith 1952) to describe the outcomes of the cluster analyses. Therefore, those undecorated assemblages having high proportions of Tusayan Gray Ware are glossed as "Anasazi"; those with high proportions of Prescott Gray Ware as "Prescott"; those with high proportions of Alameda Brown Ware, "Sinagua"; and those with high proportions of San Francisco Mountain Gray Ware, "Cohonina."

As in the preceding examination of ware percentages, some restrictions have been applied to the data used in the cluster analysis. First, only those sites with reliable sherd-count data (i.e., data types 1, 2, or 3) are used. Second, only undecorated (i.e., unpainted) types from the four major wares (Tusayan, San Francisco Mountain, and Prescott Gray Wares and Alameda Brown Ware) are employed to create the groups, with all undecorated types summed to provide a denominator for calculating percentages. Third, only those sites having at least one undecorated sherd are included in the cluster analysis. (Although this may seem a trivial consideration, inclusion of sites without undecorated sherds would seriously affect the outcome of clustering routines.) Using these criteria, a total of 1,042 sites (43.5%) was found suitable for analysis.

Cluster Analysis: Background

The particular type of cluster analysis employed in this study (see Anderberg 1973 for a discussion of different kinds of cluster analyses) works as follows. A site is assigned to a cluster--a potential "cultural" group--in terms of how close (measured in Euclidean distance; Norusis 1988:B92) the percentages of the four major undecorated wares are to the center of a cluster. In this case, because the cluster centers were unknown prior to the analysis, they had to be estimated from the data. This was accomplished as follows (Norusis 1988:B95-98). First, provisional cluster centers were established after a certain number of cases had been processed. Second, these cluster centers were modified as more cases were processed, and new ones were established if the data began to express a large amount of variability that could not be handled by the original cluster centers. Thus, to eliminate bias and to accommodate the widest possible range of variation, this moving-centroid method of cluster analysis

was characterized by two rounds of classification. That is, after all the cases have been classified according to the provisional centers, average values of the variables (were percentages) were recomputed and the classification of cases underwent another iteration. This second round of classification produced a single solution that allocated cases (sites) to clusters ("cultural" groups) on the basis of their distances (based on ware percentages values) to cluster centers that were provisionally established, checked, and if need be, re-established from the configuration of the total data file.

The only aspect of this process that was not completely controlled by the computer was the designation of how many clusters the program must produce. After experimenting with several cluster solutions, which ranged from four to 14 clusters, it appeared that a seven-cluster solution produced the most clearly interpretable results (Table 5.43).

Cluster Interpretations

Table 5.43 shows the mean scores for variables (the four major wares) that were used to derive the final seven-cluster solution. The numbers under the variable headings are the actual mean percentage values that each ware contributed to the cluster center (they need not, and often do not, sum to 100% within a cluster). It is important to note that the cluster center is used simply as an "anchor" to guide the allocation of cases (sites) to the most appropriate cluster.

Cluster 1 appears to represent those sites (n = 614, or 58.9%) that can be called "Anasazi" based on the strong contribution that Tusayan Gray Ware makes to the cluster center (91%). Cluster 2 is composed of 169 sites (16.2%) with mixed assemblages where Tusayan Gray Ware accounts for slightly over one-half (51.3%) of the undecorated ceramics and Alameda Brown Ware accounts for almost 43%. These sites are called "Anasazi/Sinagua" to indicate the nature of their mixed assemblages. Cluster 3 represents 67 (6.4%) "pure Sinagua" sites because Alameda Brown Ware accounts for over 94% of the plain-ware assemblages. Cluster 4 represents another set of sites (n = 124, or 11.9%) with mixed undecorated assemblages. Again, given the nature of the mixture, they are termed "Cohonina/Anasazi" sites. Eight sites (0.8%), having low representation of the four major wares, form Cluster 5. Because Alameda Brown Ware and Prescott Gray Ware contribute about 15% and 6%, respectively, to the makeup of this cluster, its members might best be referred to as "Sinagua/Prescott" sites. In view of the high relative frequencies that San Francisco Mountain Gray Ware makes to Cluster 6 (94%), members of this group (n = 56, or 5.4%) may best be referred to as "Cohonina" sites. Similarly, because Cluster 7 (four sites, or 0.4%) exhibits high average values of Prescott Gray Ware, its members might be categorized as "Prescott" sites.

Spatial Patterns of Clusters

Five of the groups identified by the cluster analysis had members with 30 or more undecorated sherds: "Anasazi" (n = 172); "Sinagua" (n = 9); "Cohonina" (n = 4); "Anasazi/Sinagua" (n = 59); and "Cohonina/Anasazi" (n = 52). (Three sites that were included in percentage calculations given above were not available for use in the cluster analysis; hence, the total sample of sites considered here sums to 296, not 299 as was the case for percentage data. Otherwise, the sample is precisely the same.)

TABLE 5.43. Final Cluster Centers for Cluster Analysis of Undecorated Ceramic Assemblages.

Cluster Number	Alameda Brown Ware	San Francisco Mntn. Gray Ware	Prescott Gray Ware	Tusayan Gray Ware	No. of Sites
1	4.3211	3.3043	1.1865	90.9676	614
2	42.8846	3.3537	1.4382	51.2757	169
3	94.1468	1.4640	0.0649	4.2919	67
4	10.4768	47.8186	1.4570	39.6774	124
5	14.7917	1.2500	6.2500	0.0000	8
6	1.1366	93.9165	0.0000	4.8419	56
7	0.0000	3.1250	88.5417	8.3333	4

				TOTAL	1,042

Distributions of "Anasazi," "Sinagua," and "Cohonina" sites are shown in Figures 5.33, 5.34, and 5.35. These figures reveal patterns similar to those for sites with at least 75% Tusayan Gray Ware (Figure 5.24), Alameda Brown Ware (Figure 5.27), and San Francisco Mountain Gray Ware (Figure 5.29), respectively. That is, like sites having a minimum of 75% Tusayan Gray Ware. "Anasazi" sites appear to be distributed throughout the Monument. "Sinagua" sites, like their counterparts with 75% or more Alameda Brown Ware, are found in a restricted area around Wupatki Pueblo and along the south-central boundary of the Monument. Similarly, the distribution of "Cohonina" sites closely follows the far western positions of sites having at least 75% San Francisco Mountain Gray Ware. It would thus appear that the sample of sites with 75% or more of a major undecorated ware is nearly the same population that the cluster analysis classified as culturally unambiguous, and furthermore, that the spatial patterns revealed by each method (strict consideration of percentages and the cluster analysis) are nearly identical.

"Anasazi/Sinagua" and "Cohonina/Anasazi" sites constitute the sample of sites identified by the cluster analysis as having "mixed" ceramic assemblages. Distributions of these sites are given in Figures 5.36 and 5.37. Although the sample of "mixed" sites revealed by the cluster analysis (n = 111) is much higher than the sample identified through percentage criteria alone (n = 28), some familiar spatial trends may be observed. First, "Cohonina/Anasazi" sites, like "pure Cohonina" sites and sites with 50% or more San Francisco Mountain Gray Ware, are heavily concentrated in the western portion of the Monument. Interestingly, however, a number of sites extend along the extreme southern boundary of the Monument, and a single site occurs in the Wupatki Basin just east of Wupatki Pueblo.

Second, "Anasazi/Sinagua" sites appear to be distributed in a manner generally resembling the distribution of sites having at least 50% Alameda Brown Ware; that is, they are most heavily concentrated in the vicinity of Wupatki Pueblo and along the mid-south boundary of the Monument, northwest of Doney Mountain. However, a

FIGURE 5.33. Wupatki National Monument, "Anasazi" Sites Identified by Cluster Analysis, ≥ 30 Undecorated Sherds.

FIGURE 5.34. Wupatki National Monument, "Sinagua" Sites Identified by Cluster Analysis, ≥ 30 Undecorated Sherds.

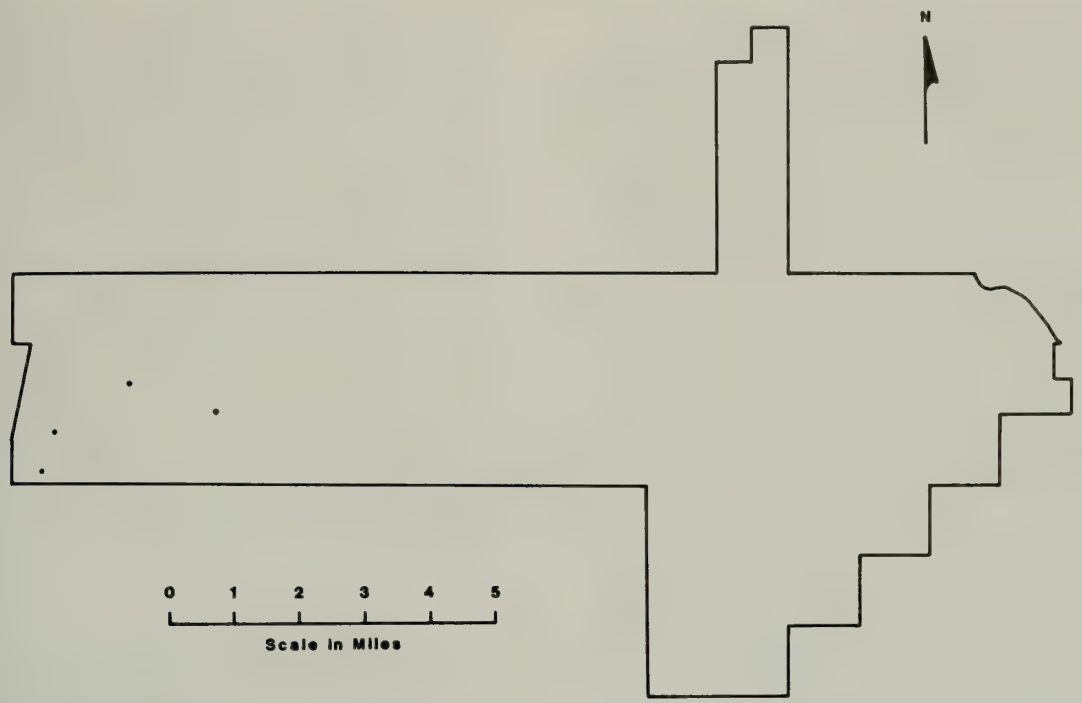


FIGURE 5.35. Wupatki National Monument, "Cohonina" Sites Identified by Cluster Analysis, ≥ 30 Undecorated Sherds.

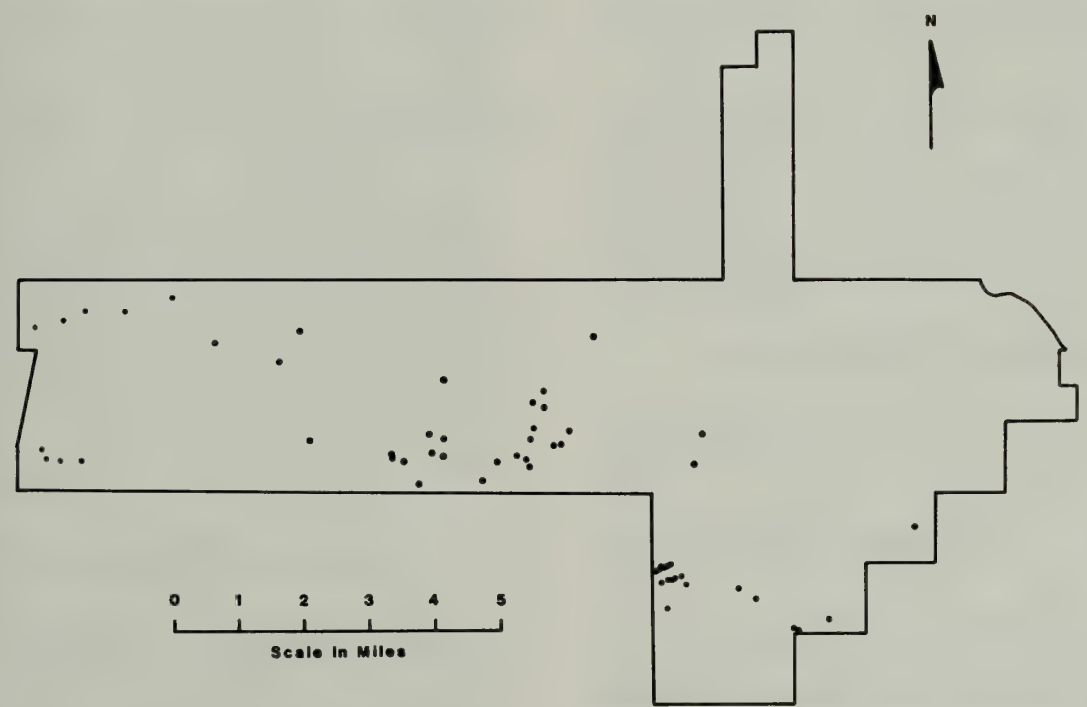


FIGURE 5.36. Wupatki National Monument, "Anasazi/Sinagua" Sites Identified by Cluster Analysis, ≥ 30 Undec. Sherds.

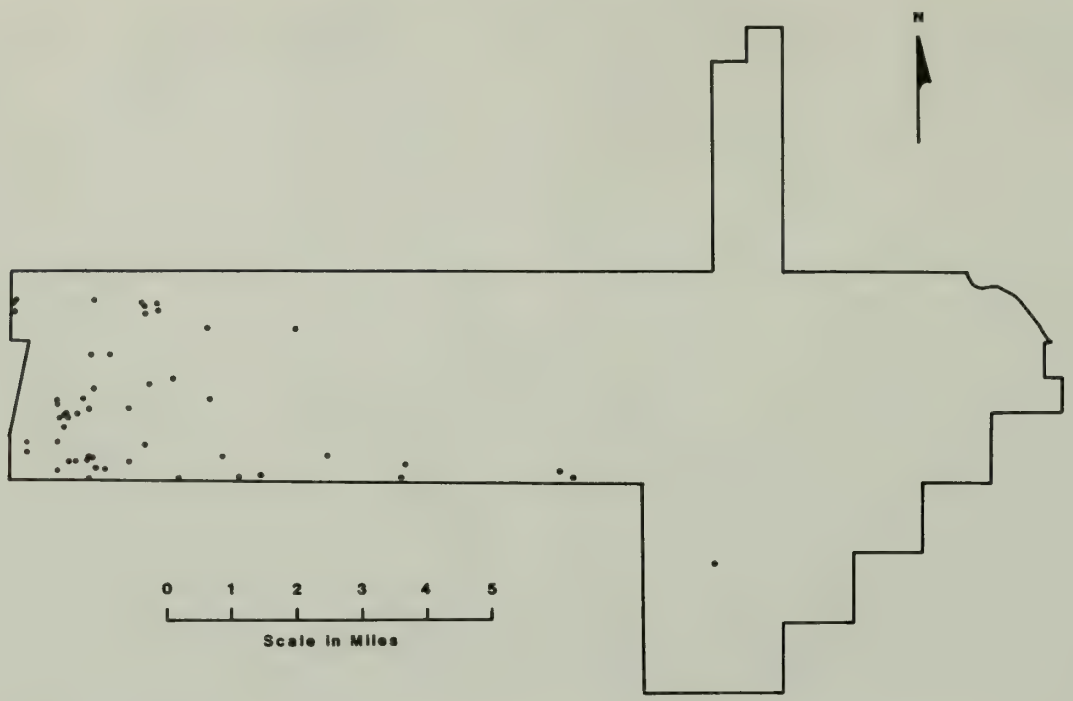


FIGURE 5.37. Wupatki National Monument, "Cohonina/Anasazi" Sites Identified by Cluster Analysis, ≥ 30 Undecorated Sherds.

relatively small sample of such sites also extends well beyond these two areas. In particular, there is an arc of "Anasazi/Sinagua" sites extending from the northwestern corner of the Monument, north of the Citadel and southeast onto Antelope Prairie, and there is a small cluster of sites in the extreme southwest corner.

Summary and Conclusions

In this section, we have described the distribution of the four major undecorated wares at Wupatki National Monument: Tusayan, San Francisco Mountain, and Prescott gray wares and Alameda Brown Ware. Two methods were used. The first consisted of a simple consideration of percentage values of the wares at a sample of 299 sites that had both quantitative ceramic assemblage data and 30 or more undecorated sherds. The second was a cluster analysis that examined the undecorated assemblages of a much larger sample (n = 1, 042) of sites. Selection requirements for the cluster analysis were that the sites have quantitative assemblage data nd at least one undecorated sherd.

The two methods yielded comparable results. It is clear that a large majority of sites at Wupatki National Monument have high percentages of Tusayan Gray Ware in their undecorated assemblages, and thus would be characterized in traditional cultural nomenclature as "Anasazi." A much smaller number of sites had Alameda Brown Ware ("Sinagua") and San Francisco Mountain Gray Ware ("Cohonina")assemblages. Both methods revealed ceramically "mixed" sites having some combination of Tusayan Gray Ware, San Francisco Mountain Gray Ware, or Alameda Brown Ware. Prescott Gray Ware was found to be an uncommon component of undecorated assemblages.

Both methods revealed similar spatial distributions of undecorated wares. In

general, sites with high proportions of Tusayan Gray Ware occur in all portions of the Monument, while sites dominated by San Francisco Mountain Gray Ware or Alameda Brown Ware show much more restricted distributions. It was observed that San Francisco Mountain Gray Ware is most abundant in the far western portion of the Monument and Alameda Brown Ware in the southern reaches, particularly around Wupatki Pueblo. Ceramically "mixed" sites appear generally to overlap with the combined distributions of Alameda Brown Ware and San Francisco Mountain Gray Ware.

A Functional Typology of Wupatki Sites

Identifying the range of activities performed at prehistoric sites is no easy task, even when excavation data are available. More difficult still are the tasks of specifying the seasons of site occupation or use, and inferring the roles and inter-relationships of various sites in larger systems of settlement or off-settlement activities. The use of surface evidence alone renders all such exercises that much more difficult and subject to error. Nonetheless, a principal goal of the present chapter is to provide some assessment of the possible activities, seasons of occupation, and functional roles of the prehistoric sites on Wupatki National Monument.

Sites without Architecture

In Descriptive Summary of Site Types and Site Characteristics, above, we presented descriptive summaries of the various "types" of sites identified by the Wupatki Survey. The functions of those site types are to some extent implied in their names. Thus, the inferred functions of agricultural fields (Site Type 2), reservoirs (Site Type 3), building-stone quarries (Site Type 5), shrines (Site Type 6), and burial areas (Site Type 8) require no further elaboration, although the inferences themselves may require verification. Members of Site Type 9, "Isolated Artifact of Special Significance," cannot, of course, be considered in functional terms. These sites, only two in number and having quite different contents, were recorded primarily as a means of marking the locations and characteristics of particularly significant artifacts. They will not be considered further. The functions of "cist" sites (Site Type 4) are unclear, although a number of possible uses for the cist features (e.g., graves, extramural hearths, storage facilities, or mealing bins) were suggested. Petroglyph sites (Site Type 7) pose an intriguing set of problems, but a study of such sites is beyond the scope of the present study. The functions of artifact scatter sites (Site Type 1) are unknown and will remain so until additional data are collected. Some, particularly those on terraces near the Little Colorado River, appear to have been used as chipping stations in the procurement of the abundant lithic raw materials that occur on the terraces. Others, however, may mark the locations of pithouse villages or other significant subsurface remains, and only further research, including test excavations, can resolve the issue.

Sites with Architecture

What remains to be considered, then, are the 2,209 archaeological sites (92%) classified as Site Type 0, or sites exhibiting architectural remains. the remainder of this section is devoted to considering the possible functions, seasons of occupation, and

roles of such sites in prehistoric Wupatki-area settlement systems. As with all other analyses presented in this report, we acknowledge the limitations of surface evidence, and we stress again that all conclusions presented herein should be regarded as propositions in need of further investigation, including the collection of excavation data.

Enclosure; Sites with Seven or More Architectural Spaces, and Sites with Depressions or Evident Pit Structures

Of the 2,209 sites with architectural remains, three categories appear least ambiguous in functional terms: (1) enclosure sites; (2) sites with seven or more architectural spaces; and (3) sites with depressions or evident pit structures.

By definition, enclosures do not have any internal dimension equalling or exceeding two meters, an attribute that would seem to severely limit the range of activities that might be performed within them. Other attributes, such as generally low frequencies of artifacts, low structure wall heights, and a limited frequency of structure elaborations such as wing or free-standing walls (Descriptive Summary of Site Types and Site Characteristics, above), seem to indicate that enclosure sites were probably not used for extended habitation. Precisely what they were used for will not be known without further study, but we suggest that they were likely employed in a number of short-term activities that required minimal shelter and resulted in the deposition of a small number of artifacts. Such activities might have included hunting or wild-plant food-gathering forays, trips involving the collection of lithic resources, or, most probably, agricultural tasks (Bradley 1959). Thus, although enclosures may have been used for a number of short-term activities, it appears that few, if any, were ever used for prolonged habitation.

On the other hand, sites having more than seven architectural spaces and sites with evident pit structures or suspected structure depressions appear the most likely to have been used as habitations. This conclusion is based on three lines of evidence. First, sites having seven or more architectural spaces generally exhibit a number of architectural attributes indicating that they were designed to provide substantial shelter for a wide range of activities. As discussed in Descriptive Summary of Site Types and Site Characteristics, above, relatively high proportions of sites in this category have multiple stories, or wall heights in excess of one meter, and a majority have structure elaborations such as wing or freestanding walls. Such sites are also commonly constructed of sandstone slabs, a material that appears to have been a considerably more stable building medium than basalt or limestone. All of these characteristics seem to indicate that sites having more than seven architectural spaces were generally substantial and well constructed, and would have been well suited for the performance of a variety of indoor and outdoor activities.

Second, the variety and frequency of artifacts at such sites suggest that a wide variety of activities were indeed performed over substantial periods of time. As discussed in Descriptive Summary of Site Types and Site Characteristics, above, a majority of sites having seven or more architectural spaces exhibit a combination of ceramics, chipped-stone debitage, and ground-stone tools. Other artifact categories, such as flaked-stone tools, cores, hammerstones, hoes, and basalt cylinders, are also commonly represented. In addition, surface artifact frequencies are nearly always at the highest end of the scale. It should be further noted that these patterns

were observed in spite of the fact that some of the largest sites are also the most heavily visited and presumably subject to the most severe impacts of unauthorized surface collections.

Third and last, the inference of a habitation function for sites with seven or more architectural spaces is also supported by excavation data from sites of comparable size on or near Wupatki National Monument. Sites such as Wupatki (NA 405; Colton 1946a:55-63), Nalakihu (NA 358; King 1949), Three Courts (NA 618; Smith 1952:8-28), and Juniper Terrace (NA 1814; Colton 1946a:145-155; Smith 1952:77-80) disclose a range of features and artifacts that may reasonably be interpreted as evidence of a habitation function. That is, they were likely used for activities such as sleeping, food preparation, food storage, ceremonies, and artifact manufacture. Given that the features, site layouts, and surface artifacts at unexcavated sites with seven or more spaces often match those of the excavated sites, we suspect that excavation of the former group would indicate similar activities as well.

We further suggest that such sites were probably occupied year-round. Although many sites are located a considerable distance from a permanent source of drinking water, this would not have been an insurmountable problem for a prehistoric population dedicated to permanent settlement. As Ritterbush (1984) has pointed out, the numerous prehistoric wet-weather ponds on and around the Monument could have supplied many sites with water during the summer and winter rainy seasons. During dry periods, domestic water needs could have been met with daily trips to area springs or to the Little Colorado River. Although such a system of water procurement may seem "inconvenient" by our own standards, it is not beyond the range of ethnographically documented behavior (Castetter and Bell 1942:42; Karmon 1966; Morgan 1955; cited by Ritterbush 1984:99-100), particularly when strong attractions--e.g., productive agricultural lands--exist that would encourage permanent settlement (Chisholm 1979:102, cited by Ritterbush 1984:100).

We also argue that sites with evident pit structures or suspected structure depressions were used for permanent habitation. This inference is based largely on evidence obtained from many excavations of eleventh-, twelfth-, and thirteenth-century pit structures in the Flagstaff area, including examples on Wupatki National Monument (e.g., Anderson 1980; Colton 1946a:46-49, 120-123, 128-155, 168-173, 204-206; Hargrave 1933; Smith 1952). Because these structures have revealed a range of internal features and associated artifacts that might be expected from habitation structures or ceremonial structures associated with nearby habitations, it seems reasonable to expect that unexcavated pit structures on Wupatki National Monument would exhibit similar inventories of items and facilities. Therefore, at the present time we equate evidence of subsurface structures with a habitation function.

Again, although the issue of seasonal occupation is for the moment unresolved, we see no reason at this point to regard pit structures any differently than substantial masonry rooms. The sizable labor investment involved in the construction of pit structures and the suitability of subterranean structures as winter shelters are to us highly suggestive, if not persuasive, indices of residential stability. For the reasons cited above, we also do not regard a modern scarcity of surface water as an insurmountable barrier to the year-round prehistoric habitation of pit structures anywhere on the Monument.

Functions of Remaining Sites with Architecture: Cluster Analysis

If the above arguments regarding the functions of enclosure sites (n = 288) are accepted--sites with seven or more architectural spaces (n = 118) and sites with evident pit structures or suspected structure depressions (n = 189, of which 55 also belong to the category of seven or more architectural spaces)--we are still left with the dilemma of resolving the functions of the majority of prehistoric architectural sites on Wupatki National Monument (n = 1,669).

To address this problem, we turned once again to the statistical technique of cluster analysis. First, however, we decided to exclude all sites among the remaining 1, 669 that have 500 or more surface artifacts (n = 39). This criterion is admittedly somewhat arbitrary, but as will be argued in more detail later in this chapter, we believe that these sites constitute special examples of small masonry sites and merit consideration as provisional habitation loci.

With these sites excluded, 1,630 sites remained. however, 18 of the remaining sites were also eliminated because they lacked observations on a key variable, surface-artifact frequency. Thus, 1,612 sites, representing 67.3% of all prehistoric sites and 83.9% of all sites with architectural spaces, were used in the analysis.

As with the cluster analysis pursued in A Preliminary Consideration of Undecorated Ceramic Assemblages, above, we turned again to agglomerative hierarchical clustering as provided by the SPSS/PC+ routine, QUICK CLUSTER (Norusis 1988:B91-B101). The variables used in forming clusters among the 1,612 sites were (1) number of structures; (2) number of masonry rooms; and (3) artifact frequency. The first two variables were read directly from the data file as the actual number of structures and the actual number of rooms. Given the criteria used to obtain the 1,612 sites used in the cluster analysis values for structures and rooms ranged from 1 to 6. Artifact frequency, recorded as an ordinal variable in the original data file, was recoded for the cluster analysis. The ordinal scale ranking was retained, but those sites having no artifacts, originally coded as = 9, were recoded as = 0 for this analysis. Thus, the variable "artifact frequency" ranged in value from 0 (no artifacts) to 4 (101-500). This recoding procedure, and constraints on the number of structures and rooms, should be borne in mind when interpreting the results of the cluster analysis.

Unlike the clustering problem faced in A Preliminary Consideration of Undecorated Ceramic Assemblages, above, (characterization of ceramic assemblages in terms of possible combinations of four major wares), in this analysis we did not have a clear idea of how many clusters should be specified in the QUICK CLUSTER procedure (Norusis 1988:B95-B98). After examining the results of 10 different solutions, which specified between 3 and 12 clusters, we decided that the solution with 5 clusters provided the most directly interpretable results (Table 5.44).

Cluster 1.Cluster 1, with 490 sites, is characterized by a low mean number of structures (1.2), a low mean number of rooms (1.6), and a high mean score for artifact frequency (3.2). Thus, a typical member of this cluster would have one structure, one or two rooms, and 26-100 artifacts. Table 5.45 provides breakdowns of Cluster 1 by structures, rooms, and artifact frequency. This table shows, indeed, that a large majority (n = 415, or 85%) of Cluster 1 sites have only one structure (n = 415, or 85%) and one or two rooms (n = 441, or 90%), and that nearly three-quarters (n = 353, or 72%) have between 26 and 100 artifacts.

Approximately one-fourth (n = 126, or 26%) of the sites have from 101 to 500 artifacts. Ten percent of the sites (n = 49) have three rooms, but these sites always have only one structure. As might be expected given the relatively high artifact frequencies for these sites, a high proportion (74%; n = 365) could be dated to one or more periods (Table 5.46).

Cluster 2, with 966 sites, is characterized by a low mean number of structures (1.1), a low mean number of rooms (1.2), and a low mean score for artifact frequency (1.2). Sites in this cluster typically have only one structure and one room (n = 773, or 80%), and they never have more than 25 artifacts (Table 5.47). A few sites (185, or 19%) have two rooms, and eight sites (less than 1%) have three rooms. All eight sites with three rooms have only one structure and from one to 10 artifacts. Not surprisingly, only a small proportion (19%; n = 184) of these sites could be dated (Table 5.48).

Cluster 3 comprises only 21 sites. This cluster exhibits a high number of structures, a high number of rooms, and a moderate to

TABLE 5.44. Final Cluster Centers and Number of Sites in Each Cluster

Cluster	Structures	Rooms	Artifact Frequency	Number of Sites
1	1.1531	1.6184	3.2347	490
2	1.0484	1.2081	1.1667	966
3	3.8095	5.3333	3.3810	21
4	1.4878	4.6585	3.3902	41
5	2.9149	3.4681	2.2128	94

TABLE 5.46. Period of Occupation or Use for Cluster 1 Sites.

Period 2	7
Period 3	41
Period 4	128
Period 5	8
Periods 2 and 3	9
Periods 2 and 4	14
Periods 2 and 5	2
Periods 3 and 4	90
Periods 3 and 5	2
Periods 4 and 5	21
Periods 2, 3, and 4	16
Periods 2, 4, and 5	2
Periods 3, 4, and 5	24
Periods 2, 3, 4, and 5	1
Undated	125

TABLE 5.45. Breakdown of Cluster 1 Sites by Structures, Rooms, and Artifact Frequency.

Structures	Rooms	Artifact Frequency	Number of Sites
1	1	26-100	212
1	1	101-500	49
1	2	26-100	72
1	2	101-500	33
2	2	26-100	44
2	2	101-500	31
1	3	11-25	11
1	3	26-100	25
1	3	101-500	13

high frequency of artifacts. The number of structures ranges from three to five, and the number of rooms is generally five or six (Table 5.49). Two sites have only four rooms. Artifact frequencies are generally between 26 and 500, although one site has only 11 to 25 items.

Table 5.50 lists the results of dating efforts for Cluster 3 sites. This table shows a wide range of period assignments, with a majority of sites(11, or 52%) having multiple periods represented. Not unexpectedly, given the moderately high artifact frequencies for this cluster, only four sites (19%) could not be dated.

Cluster 4, with 41 sites, is typified by a low number of structures (mean = 1.5), a high number of rooms (mean = 4.7), and artifact frequencies ranging generally from 26 to 500 (mean = 3.4). Most sites (n = 30, or 95%) have only one or two structures (two have three), and all have from four to six rooms (Table 5.51). Almost all of the sites (38, or 93%) have from 26 to 500 artifacts. Nearly half (20, or 49%) were dated to more than one period, and 11 (27%) were dated to Period 4 only (Table 5.52). Only eight sites (20%) could not be dated.

TABLE 5.48. Periods of Occupation or Use for Cluster 2 Sites.

Period 1	1
Period 2	4
Period 3	23
Period 4	104
Period 5	9
Periods 2 and 3	3
Periods 2 and 4	3
Periods 2 and 5	1
Periods 3 and 4	25
Periods 4 and 5	8
Periods 3, 4, and 5	2
Periods 2, 3, 4, and 5	1
Undated	782

Cluster 5, with 94 members, is a relatively diverse group of sites, exhibiting a wide range of variability in structures (from one to five), rooms (from three to six), and artifact frequencies (from 0 to 500) (Table 5.53). As shown in Table 5.44, mean scores for structures is 2.9, for rooms, 3.5, and for artifacts, 2.2. Nearly one-half of the sites (n = 44, or 47%) could not be dated, and a majority of the datable sites (n = 35, or 70%) could be assigned to only one period (Table 5.54).

TABLE 5.47. Breakdown of Cluster 2 Sites by Structures, Rooms, and Artifact Frequency.

Structures	Rooms	Artifact Frequency	Number of Sites
1	1	0	144
1	1	1-10	385
1	1	10-25	244
1	2	0	10
1	2	1-10	49
1	2	10-25	50
1	3	1-10	8
2	2	0	8
2	2	1-10	39
2	2	11-25	29

TABLE 5.49. Breakdown of Cluster 3 Sites by Structures, Rooms, and Artifact Frequency.

Structures	Rooms	Artifact Frequency	Number of Sites
3	5	26-100	3
3	5	101-500	3
3	6	26-100	1
3	6	101-500	3
4	4	101-500	2
4	5	26-100	1
4	5	101-500	1
4	6	11-25	1
4	6	26-100	1
5	5	26-100	1
5	5	101-500	1
5	6	26-100	1
5	6	101-500	1

TABLE 5.50. Periods of Occupation or Use for Cluster 3 Sites.

Period 3	1
Period 4	4
Period 5	1
Periods 3 and 4	3
Periods 4 and 5	2
Periods 2, 3, and 4	4
Periods 3, 4, and 5	1
Periods 2, 3, 4, and 5	1
Undated	4

Interpretation of Clusters

An attempt may now be made to interpret the clusters in terms of possible site functions and history of site formation.

Of all the clusters, Cluster 2 appears to be the most readily interpretable in functional terms. With a low number of structures, low number of rooms, and low number of artifacts, members of this cluster are probably best classified as "field houses," or structures associated with short-term agricultural pursuits. As such, they might be considered functionally equivalent to "enclosure" sites. Whatever the exact activities that were performed at Cluster 2 sites, it is evident that they required neither a high number of rooms nor a substantial structure, and did not result in the deposition of a great variety or number of artifacts. Thus, we are confident that few if any Cluster 2 sites served a habitation function.

Another cluster that appears to present few major interpretive difficulties is Cluster 4. Because this cluster is characterized by a low number of structures, high number of rooms, and high artifact frequencies, its members would appear to represent compact, multi-roomed structures with significant trash accumulations. These sites therefore probably represent examples of "unit" pueblos, or single household, intensively occupied dwellings that might have been inhabited year-round. Conversely, they may represent seasonally occupied "farmsteads" that replicate the rooms and facilities used in other seasons at larger "home-base" sites. In either case, sites belonging to Cluster 4 appear to represent some form of a "habitation" site occupied for at least a portion of the year.

The remaining three clusters--1, 3, and 5--present more ambiguous evidence of possible functions. Cluster 1 sites (n = 490)

TABLE 5.51. Breakdown of Cluster 4 Sites by Structures, Rooms, and Artifact Frequency.

Structures	Rooms	Artifact Frequency	Number of Sites
1	4	26-100	9
1	4	101-500	6
1	5	11-25	1
1	5	26-100	1
1	5	101-500	2
1	6	11-25	1
1	6	101-500	3
2	4	26-100	3
2	4	101-500	3
2	5	26-100	2
2	5	101-500	3
2	6	11-25	1
2	6	26-100	4
3	4	101-500	2

TABLE 5.52. Periods of Occupation or Use for Cluster 4 Sites.

Period 3	1
Period 4	11
Period 5	1
Periods 3 and 4	3
Periods 3 and 5	1
Periods 4 and 5	3
Periods 2, 3, and 4	2
Periods 2, 4, and 5	1
Periods 3, 4, and 5	6
Periods 2, 3, 4, and 5	4
Undated	8

represent a significant proportion of all prehistoric sites, but functions are not entirely clear. Given their relatively high artifact frequencies, it is possible that these sites might represent habitations. However, most Cluster 1 sites have only one or two rooms, and a majority (261, or 53%) have only a single structure and a single room. Thus, unless a large number of these sites are now partially buried by sediments, were composed largely of now-melted jacal rooms, or have subterranean structures that are not now visible, it seems unlikely that they could have provided the living space or facilities required for seasonal or year-round habitation by a household or other viable economic unit. It seems more likely that such sites represent one- or two-room field houses that were either more intensively used than their Cluster 2 counterparts or were used over a more extended period of time.

Clusters 3 and 5 appear in many respects to be similar. Both have relatively high means for number of structures (an average of nearly four for Cluster 3 and nearly three for Cluster 5) and number of rooms (approximately 5.3 for Cluster 3 and nearly 3.5 for Cluster 5). The two are evidently separated on the basis of artifact frequency: Cluster 3 has a mean score of 3.4 and Cluster 5, 2.2. thus, although the two clusters are statistically distinct, they might

TABLE 5.53. Breakdown of Cluster 5 Sites by Structures, Rooms, and Artifact Frequency.

Structures	Rooms	Artifact Frequency	Number of Sites
1	4	1-10	1
1	4	0	1
2	3	0	2
2	3	1-10	2
2	3	11-25	10
2	4	1-10	2
2	4	11-25	2
2	6	1-10	1
3	3	0	1
3	3	1-10	5
3	3	11-25	10
3	3	26-100	26
3	3	101-500	3
3	4	11-25	5
3	4	26-100	6
3	5	1-10	2
3	6	1-10	1
4	4	1-10	1
4	4	11-25	2
4	4	26-100	8
4	5	1-10	2
5	5	1-10	1

TABLE 5.54. Periods of Occupation or Use for Cluster 5 Sites.

Period 3	10
Period 4	23
Period 5	2
Periods 3 and 4	10
Periods 4 and 5	2
Periods 2, 3, and 4	1
Periods 3, 4, and 5	2
Undated	44

also be considered members of a single group, usually having from three to six masonry structures and three to six rooms.

Functionally, Cluster 3 and Cluster 5 sites may represent a number of types. First, although artifact frequencies are generally not high, some sites may represent small settlements composed of discrete and perhaps functionally differentiated structures. In such cases, low frequencies of surface artifacts might be attributable to post-occupational deposition of alluvial or aeolian sediments, particularly volcanic cinders, or to relatively brief occupation spans.

Alternatively, and perhaps much more likely, some cluster 3 and Cluster 5 sites might represent repeatedly reused or reoccupied field-house sites. This interpretation is similar to the "field-house" hypothesis that

was proposed for Cluster 1 sites. In this view, Cluster 3 and Cluster 5 sites might also represent repeatedly used "field-house" locations, with the exception that new structures were occasionally built to replace older ones until a total of three to six structures (as opposed to one or two structures for Cluster 1 sites) had accumulated. The slightly higher mean scores on all variables for Cluster 3 sites might reflect slightly more intensive use or a more extended occupational history, when compared to Cluster 5 sites. Thus, Cluster 5 sites might represent attenuated examples of Cluster 3 sites, abandoned for whatever reason before they accumulated enough structures, rooms, and artifacts to merit assignment to Cluster 3.

Functional Categories of Sites with Architecture

With the preceding analyses and interpretations in hand, we will now proceed to group all sites with architecture into a few gross functional categories.

Functional Code 1.The first category, which we designate as Functional Code 1, consists of those sites considered to have the highest probability of having served a habitation function. As discussed previously, a "habitation" site is here defined as a location, probably occupied year round, that was likely used for sleeping, food preparation, food storage, artifact manufacture, and ceremonies. This category includes all sites with seven or more architectural spaces and all sites with evident pit structures or suspected structure depressions. A total of 252 sites, representing 1,842 masonry rooms and pit structures, fit these criteria.

Functional Code 2.A second category, designated Functional Code 2, represents sites that we believe are somewhat less likely to have served a habitation function but nonetheless might be provisionally classified as settlements. A total of 93 sites, with 363 architectural spaces, were assigned to Functional Code 2. This category includes all sites with one to six masonry rooms and more than 500 artifacts; all sites belonging to Cluster 4; and 13 sites from Cluster 1 having the following attributes: one structure, three rooms, and 101 to 500 artifacts.

These criteria are admittedly somewhat arbitrary, but we offer the following arguments in defense of their selection. First, sites with one to six masonry rooms and more than 500 artifacts would appear to represent the most intensively used examples of the smaller architectural sites at Wupatki National Monument, and thus become the most likely members of this size category to have been used for habitation. Although we would agree that additional data should be collected to test this proposition, at the present time it seems more reasonable to classify such sites as provisional settlements than to treat them as field houses or some similar "limited activity" taxon.

There is also some empirical evidence to suggest that sites with one to six rooms and 500 or more artifacts may represent small settlements. One of the authors (Sullivan) recently excavated a small, mid-eleventh-century Kayenta Anasazi site (AZ 1:1:17 [ASM]) near the Grand Canyon, about 50 km northwest of Wupatki National Monument (Sullivan 1986). At the surface, this site appeared as a one-room masonry structure, similar to other sites traditionally classified as "field houses" (Sullivan 1986:47). An outstanding feature of this site, however, was a relative abundance of surface artifacts (1,027 items were retrieved in surface collections; Sullivan 1986:51-52). Upon excavation, the site turned out to be a burned block of four masonry and wood structures, having a full complement of domestic artifacts and facilities and evident-

ly representing a year-round settlement (Sullivan 1986:186, 188-189). Thus, although the site might otherwise have been interpreted as a seasonally occupied field house, the abundance of surface artifacts seems to have signalled that this was in fact a substantial settlement.

The classification of Cluster 4 sites as potential habitation loci has previously been discussed. As noted, members of Cluster 4 appear to represent examples of "unit pueblos," or multi-roomed structures capable of providing the shelter and facilities necessary for year-round habitation by a household or other small economic unit. The relatively high artifact densities associated with Cluster 4 sites seem consistent with this designation. Unfortunately, however, it is not clear whether these sites are in themselves permanent habitation loci or replicate, for purposes of seasonal habitation, the rooms and facilities found at "home-base" settlements elsewhere on the Monument or beyond. Hence, they are considered "provisional" settlements pending the recovery of data that would more definitively resolve their role in the settlement system.

Selection of 13 Cluster 1 sites as potential settlements is ultimately an arbitrary decision, but one with at least some degree of logic. The 13 sites that were selected were, of course, assigned by the computer to Cluster 1. We intuitively felt, however, that they seem to have more in common with members of Cluster 4 and might legitimately be considered as additional, albeit small, examples of a "unit pueblo." All 13 sites had a single three-room masonry structure, and all had from 101 to 500 artifacts. Hence, contrary to the mathematical classification, we consider these sites functionally more similar to the "unit pueblos" of Cluster 4 than they are to the other members of Cluster 1. The same interpretive cautions discussed for Cluster 4 sites naturally apply to these 13 sites as well.

Functional Code 3.The third group of sites, which we have assigned Functional Code 3, is the most functionally ambiguous. This group consists of the members of clusters 3 and 5. Although we recognize that these sites may represent a variety of site functions or site histories, it does not seem possible to sort this variability without additional data. Thus, we candidly admit our inability to conceive a functional label for these sites and suggest that only further research can resolve the question. Clusters 3 and 5 represent 115 sites and a total of 438 architectural spaces.

Functional Code 4.The last functional group of sites, Functional Code 4, accounts for a large majority (78%; n = 1,731) of the 2,209 prehistoric architectural sites on Wupatki National Monument. This group consists of enclosure sites, cluster 2 sites, and all Cluster 1 sites except the 13 that were assigned Functional Code 2. A total of 1,921 architectural spaces are represented. As previously discussed, these sites are probably best characterized as constructions designed to provide neither substantial shelter nor the full range of rooms and facilities required for extended habitation. Given the extremely high density of agricultural features and field systems on Wupatki National Monument (Marozas 1983; Travis, this volume), it seems likely that most of the sites assigned to Functional Code 4 were probably used as "field houses," occupied on a seasonal basis during the performance of agricultural tasks or used for the short-term storage of agricultural implements or newly harvested crops. In any case, because this group of sites does not appear to have been used to house groups of people for extended periods of time, following the interpretations of Moore (1978), Pilles (1978, 1979) and Wilcox (1978), it is suggested that the

architectural spaces present at these sites are duplicated by more substantial rooms elsewhere in the settlement system.

Summary and Conclusions

In this section, we have attempted to sort the variability observed in all categories of prehistoric sites into meaningful functional classes. The bulk of our attention has been devoted to the classification of those sites exhibiting architectural features. Consideration of the functions of these sites progressed through several stages. Initially, three groups of sites were judged to present the fewest interpretive problems with respect to function: (1) enclosure sites; (2) sites with seven or more architectural spaces; and (3) sites with evident pit structures or suspected structure depressions. It was proposed that enclosure sites, because of their small size, low artifact frequency, and lack of enclosing walls and structure elaborations, probably were used only for short-term activities such as daily agricultural pursuits or resource-gathering expeditions. The latter two groups of sites, for a variety of reasons argued earlier in the chapter, may represent probable settlements where people resided on a year-round basis.

With these sites excluded from further consideration of function, 1,669 sites remained, and cluster analysis was turned to as a means of characterizing their variability with respect to three key attributes: number of structures, number of rooms, and artifact frequency. First, however, it was decided to exclude all sites with 500 or more artifacts from the cluster routine. For a variety of reasons, these sites appeared to warrant their own "intuitive" cluster. The cluster analysis was then performed, and a five-cluster solution was selected.

From the results of the preceding analyses, four functional categories of Wupatki sites were proposed: (1) Functional Code 1, sites with the highest probability of having been used as year-round settlements; (2) Functional Code 2, sites believed to have a somewhat lower but nonetheless high probability of having served a settlement function; (3) Functional Code 3, sites of indeterminate function that could have served either as settlements, seasonal farmsteads, or "field houses"; and (4) Functional Code 4 sites, interpreted as "limited-activity" sites probably used mainly as temporary shelters or storage spaces in association with agricultural activities.

It is emphasized again that these analyses represent only a first attempt to sort the wide and intriguing range of variability exhibited by the prehistoric sites on Wupatki National Monument. Additional research at all site types, including excavation, will be required to test our propositions. Nonetheless, we believe a beginning has now been made toward the solution of higher level interpretive problems. In the next section, we will explore one such problem--the estimation of prehistoric population levels.

Population Levels

To estimate the prehistoric population of Wupatki National Monument in this section, we make use of the definition of architectural spaces given in The Data Base, above, the chronological scheme presented in Chronology, above, the functional typology of sites that was proposed in A Functional Typology of Wupatki Sites, above, and a set of assumptions, discussed below, regarding the occupational histories of individual settlements and the number of persons that should be counted per architectural space. Estimates span Periods 2 through 5 (ca. A.D. 1064 to 1275) and pertain only to sites fitting

Functional Codes 1 and 2, i.e., the two categories considered most likely to have been used for habitation. Perhaps more than any other analysis presented in this report, we regard the conclusions of this section to be extremely tentative. Our intent is merely to derive a rough estimate of the magnitude of post-eruptive populations and to provide some idea of how those populations might have changed through time.

Methods and Assumptions

Because Periods 2 through 5 are of unequal length, room and pit structure counts are standardized to a 30-year interval. thus, raw counts of architectural spaces for Period 2 (66 years in length) are multiplied by a time correction factor of .4545; counts for Period 3 (30 years) remain unchanged; counts for Period 4 (60 years) are multiplied by .5000; and counts for Period 5 (55 years) are multiplied by .5454.

Time-corrected counts of architectural spaces are calculated using two methods. In the first, we make no assumptions about the occupational histories of individual sites. All architectural spaces are assumed to have been occupied throughout the life of the settlement. Thus, a site with 15 architectural spaces, occupied in Periods 3 and 4, would contribute 15 spaces to the Monument-wide total of architectural spaces for Period 3 and 15 to Period 4 as well.

A second method for figuring time-corrected counts of architectural spaces involves a crude attempt to adjust for the number of periods in which the site was occupied. This adjustment consists simply of dividing the total number of architectural spaces at the site by the total number of periods represented. A site with 15 spaces, occupied during Periods 3 and 4, would therefore contribute 7.5 architectural spaces to the Monument-wide count for Period 3 and 7.5 spaces to the total for Period 4.

The final steps in estimating population levels are to convert sums of architectural spaces to counts of people and to specify what the latter figures imply with respect to population "levels." To arrive at population counts, we assume an average of two persons per architectural space--a figure also used by Colton (1936:339-340, 1949:22-23) to estimate the population of prehistoric Flagstaff-area pueblos. Colton arrived at this average by dividing the total number of ground-floor rooms depicted on Mindeleff's 1881-1882 Hopi architectural plans (Donaldson 1893, and Mindeleff 1891, cited by Colton 1949:22-23). There are, of course, many differences between modern Hopi pueblos and late Pueblo II and early Pueblo III settlements at Wupatki, not the least of which are the greater absolute sizes and occupation spans of the Hopi structures and potential changes in room functions and dimensions from the A.D. 1100s to the A.D. 1890s. Nonetheless, the figure of two persons per architectural space seems a reasonable first approximation, and if other conversion factors strike the reader as more appropriate, they easily may be substituted.

Counts of Architectural Spaces

Tables 5.55 and 5.56 provide raw and time-corrected counts of architectural spaces, by period, for Functional Code 1 sites. The totals in Table 5.55 are simply the sum of all architectural spaces that were assigned to the particular time period. There is no correction for the total number of time periods a site was occupied or any other adjustment for possible changes through time in the number of occupied architectural spaces. It is assumed that the

total number of time-corrected architectural spaces at each site was occupied in each of the time periods represented at the site. Admittedly, this method probably overestimates the total number of occupied architectural spaces. Many sites, particularly the larger ones, probably fluctuated in size considerably as their populations grew, peaked, and declined over the course of several decades. The figures given in Table 5.55 might therefore be viewed as upper limits for total architectural spaces for Functional Code 1 sites in a given period.

Table 5.56 gives totals of architectural spaces derived by dividing a site's total spaces by the total number of time periods represented. Because it seems unlikely that a settlement would maintain a constant level of population throughout its occupational history, this method of counting may underestimate the total number of spaces for some periods. Thus, figures given in Table 5.56 might be viewed as minimum counts that provide a lower limit to the calculations presented in Table 5.55.

TABLE 5.55. Total Architectural Spaces, by Time Period, for Functional Code 1 Sites.

Time Period	Number of Sites	Raw Number of Architect. Spaces	Time-Corrected Number of Architect. Spaces
Period 2	51	457	207.71
Period 3	119	1,128	1,128.00
Period 4	180	1,573	786.50
Period 5	71	751	409.60
Undated	53	163	
Total	252	1,842	

TABLE 5.56. Architectural Spaces/Total Periods, by Time Period, for Functional Code 1 Sites.

Time Period	Number of Sites	Raw Number of Architect. Spaces	Time-Corrected Number of Architect. Spaces
Period 2	51	167.17	75.98
Period 3	119	453.35	453.35
Period 4	180	790.85	395.43
Period 5	71	267.68	146.00

Tables 5.57 and 5.58 list the totals of architectural spaces, by time period, for Functional Code 2 sites. The methods used to calculate these totals are the same as those used to generate Tables 5.55 and 5.56.

Estimated Population Levels for Periods 2 through 5

Counts of architectural spaces in Tables 5.55-5.58 were used to derive the population estimates given in Tables 5.59-5.62. Table 5.59 gives counts of persons by time period, produced by using the total counts of architectural spaces for Functional Code 1 sites. Table 5.60 gives population figures for the same sample when architectural spaces at a site are divided by the total number of periods represented. Tables 5.61 and 5.62 are the counterparts of Tables 5.59 and 5.60 respectively, for Functional Code 2 sites.

Maximum Figures

Because they are unadjusted for the growth histories of individual settlements, the calculations given in Tables 5.59 and 5.61 may be regarded as maximum population estimates. Two options are available for interpreting these figures. The first is to

TABLE 5.57. Total Architectural Spaces, by Time Period, for Functional Code 2 Sites.

Time Period	Number of Sites	Raw Number of Architect. Spaces	Time-Corrected Number of Architect. Spaces
Period 2	18	72	32.72
Period 3	42	158	158.00
Period 4	73	287	143.50
Period 5	33	144	78.54
Undated	17	62	

TABLE 5.58. Architectural Spaces/Total Periods, by Time Period, for Functional Code 2 Sites.

Time Period	Number of Sites	Raw Number of Architect. Spaces	Time-Corrected Number of Architect. Spaces
Period 2	18	21.24	9.65
Period 3	42	59.40	59.40
Period 4	73	163.40	81.70
Period 5	33	56.91	31.04

accept only Functional Code 1 sites as potential settlements. In this case, the growth of population at Wupatki National Monument may be summarized as follows. From a resident population base of zero in pre-eruptive times, the maximum number of persons on the Monument rises to 415 during Period 2. There is then a tremendous increase in population, with Period 3 hitting a peak level (2,256) that is 544% of the peak measured for Period 2. During Period 4, the maximum population (1,573) declines by about 30%. The decrease continues in Period 5, with a peak figure (819) that is 48% below that of Period 4. The population evidently falls to zero some time during Period 5, as there is no evidence for a Period 6 occupation (see Chronology, above).

TABLE 5.59. Time-Corrected Population Estimates for Functional Code 1 Sites, No Adjustment for Total Periods Represented at Site.

Time Period	Number of Persons
Period 2	415
Period 3	2,256
Period 4	1,573
Period 5	819

TABLE 5.60. Time-Corrected Population Estimates for Functional Code 1 Sites, Total Architectural Spaces/Total Periods.

Time Period	Number of Persons
Period 2	152
Period 3	907
Period 4	791
Period 5	292

TABLE 5.61. Time-Corrected Population Estimates for Functional Code 2 Sites, No Adjustment for Total Periods Represented at Site.

Time Period	Number of Persons
Period 2	65
Period 3	316
Period 4	287
Period 5	157

TABLE 5.62. Time-Corrected Population Estimates for Functional Code 2 Sites, Total Architectural Spaces/Total Periods

Time Period	Number of Persons
Period 2	19
Period 3	119
Period 4	163
Period 5	62

A second option is to calculate population levels using both Functional Code 1 and 2 sites. In this scenario, population grows from zero in pre-eruptive times to a peak of 480 in Period 2; dramatically increases to a high of 2,572 (a 536% increase) during Period 3; falls by 28% during Period 4 to a peak figure of 1,860; continues to decline in Period 5 to 976 persons (a 48% decrease over the Period 4 high); and drops again to zero by the onset of Period 6.

Minimum Figures

The second method of estimating Monument-wide population is to use the lower population figures derived by dividing the total number of architectural spaces at a site by the total number of periods that the

FIGURE 5.38. Wupatki National Monument, Functional Code = 1, Period 2.

site was occupied. These figures are presented in Tables 5.60 and 5.62. As with the maximum figures presented in Tables 5.59 and 5.61, we will first consider only those sites classified as Functional Code 1. According to this method, population rises from zero in the pre-eruptive period to a peak of 152 persons in Period 2. Period 3 sees a dramatic increase in peak population--to 907, or 597% of the Period 2 high. In Period 4 there is a decrease of about 13% over Period 3 levels, as peak population falls to 791 persons. The Period 5 peak continues the decline, falling by nearly 63% to a maximum figure of 292 persons. The occupation evidently does not continue into Period 6.

A second option is to accept both Functional Code 1 and 2 sites as settlements. In this scenario, population rises from zero in the pre-eruptive period to a peak of 171 during Period 2. In Period 3, population increases by 600%, to 1,026 persons. Population declines in Period 4 to 954 persons, a 7% decrease from Period 3. The population continues to decline in Period 5, as it drops by 63% from the Period 4 high to a maximum of 354 persons. Again, by the onset of Period 6 the Monument is completely abandoned.

Spatial Trends

Figures 5.38-5.45 depict spatial trends in settlement locations through time. Figures 5.38-5.41 show locations of Functional Code 1 sites for Periods 2 through 5, and Figures 5.42-5.45 show Functional Code 2 sites for Periods 2 through 5. Figures 5.46 and 5.47 show the distributions of all Functional Code 1 and Functional Code 2 sites. While these figures do not depict population size for individual settlements, they do show trends in settlement distribution and aggregation. As might be expected, the two most densely settled districts are located near Wupatki Pueblo and in the

FIGURE 5.39. Wupatki National Monument, Functional Code = 1, Period 3.

FIGURE 5.40. Wupatki National Monument, Functional Code = 1, Period 4.

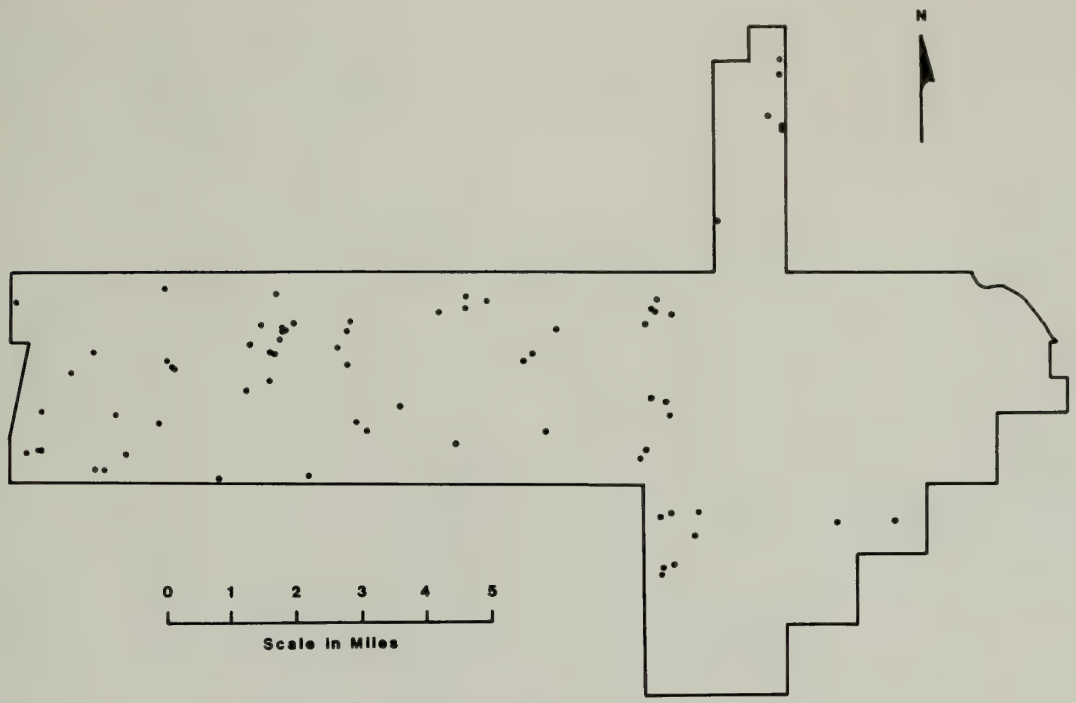


FIGURE 5.41. Wupatki National Monument, Functional Code = 1, Period 5.

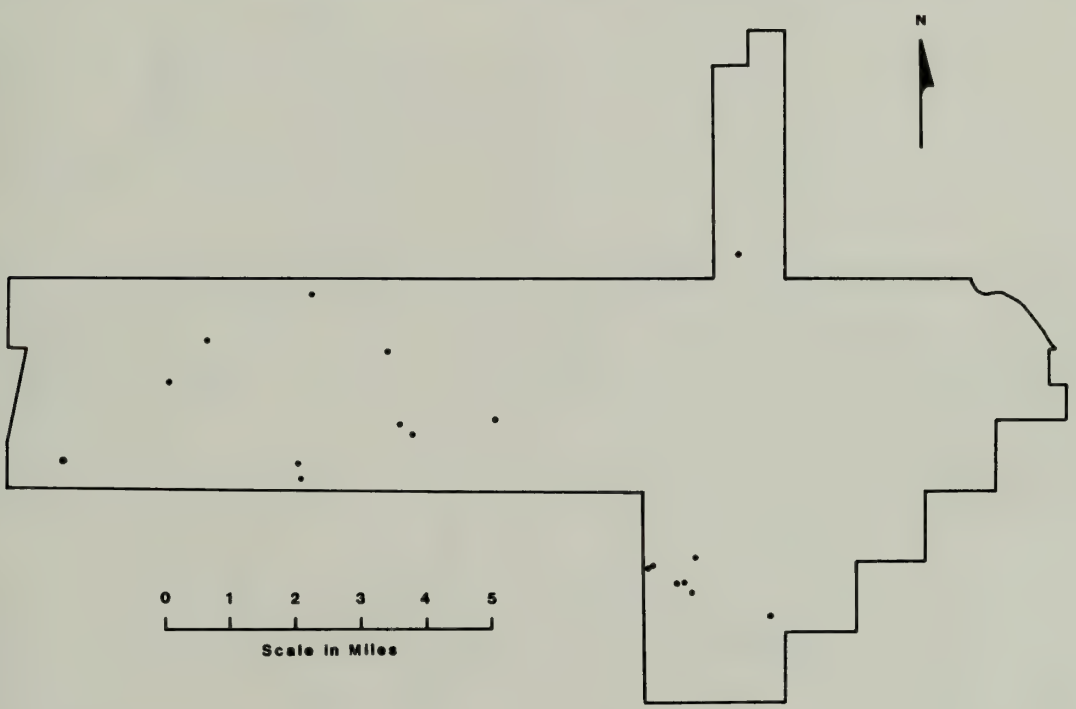


FIGURE 5.42. Wupatki National Monument, Functional Code = 2, Period 2.

FIGURE 5.43. Wupatki National Monument, Functional Code = 2, Period 3

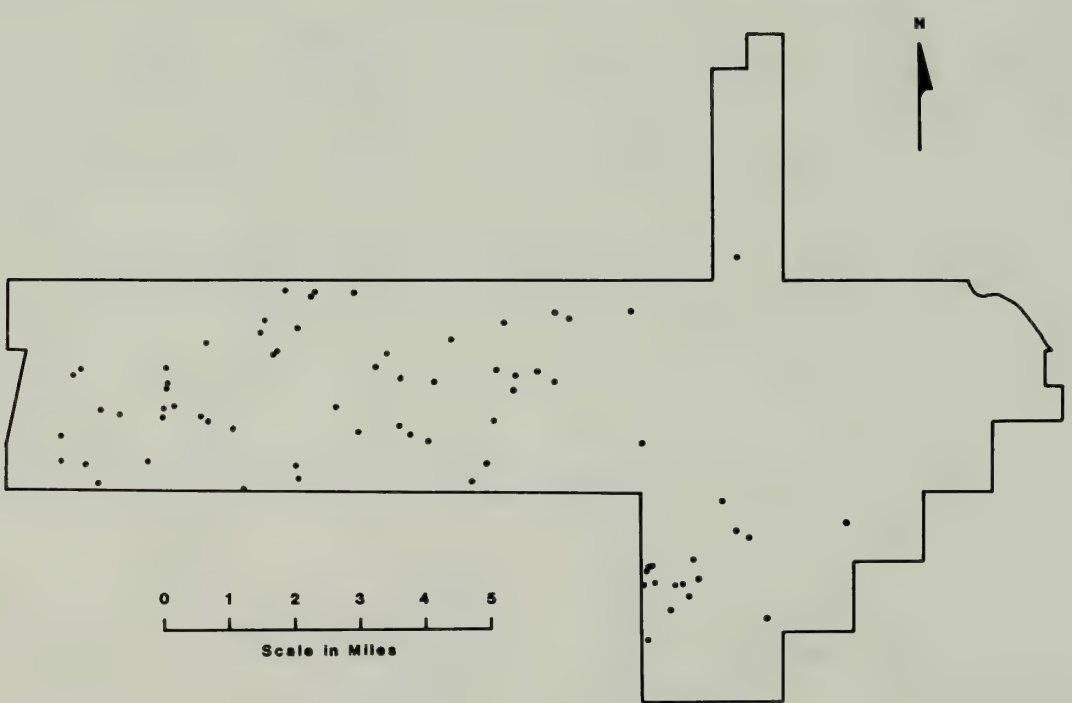


FIGURE 5.44. Wupatki National Monument, Functional Code = 2, Period 4.

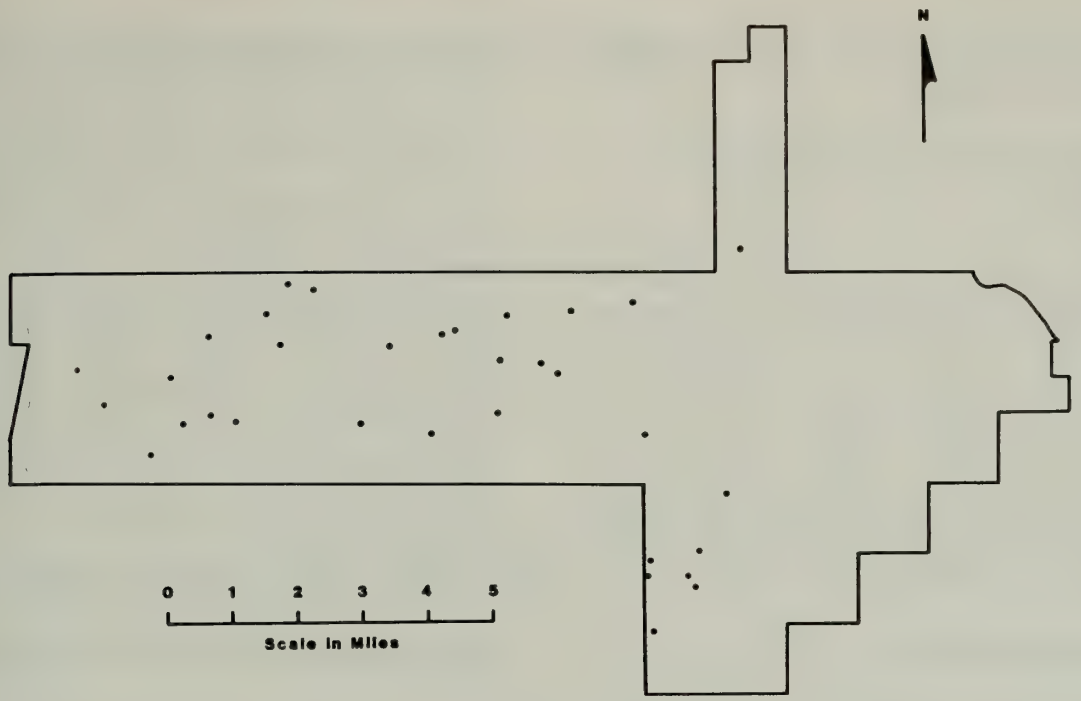


FIGURE 5.45. Wupatki National Monument, Functional Code = 2, Period 5.

FIGURE 5.46. Wupatki National Monument, Sites with Functional Code = 1.

northwestern portion of the Monument, around the Citadel.

Other Evidence of Population Growth

As a check on the population trends identified through counts of architectural spaces, we turn to two other categories of evidence: tree-ring dates and Monument-wide ceramic counts. We recognize that interpretation of such evidence is problematic, and we employ it here only to provide the most rudimentary test of our population estimates.

Tree-Ring Dates

Table 5.63 provides a stem-and-leaf diagram of all tree-ring dates reported from Wupatki National Monument (Robinson et al. 1975:38, 48, 77, 92-96). In this diagram, the "stem" is provided by the first three digits of the decade within which a given tree-ring date falls, and the "leaves" are represented by individual dates. Underlining is used to indicate cutting dates. Table 5.64 provides a synopsis of all tree-ring dates by decade, subdivided by cutting and noncutting totals. It should be noted that the large majority (94% of all dates and 91% of cutting dates) are from a single site, Wupatki Pueblo, with ten total dates and seven cutting dates from three additional sites: the Heiser Springs site (NA 1754), the Citadel (NA 355), and Nalakihu (NA 358).

Assuming that totals of tree-ring cutting dates are an index of construction activity reflects population growth, we may compare

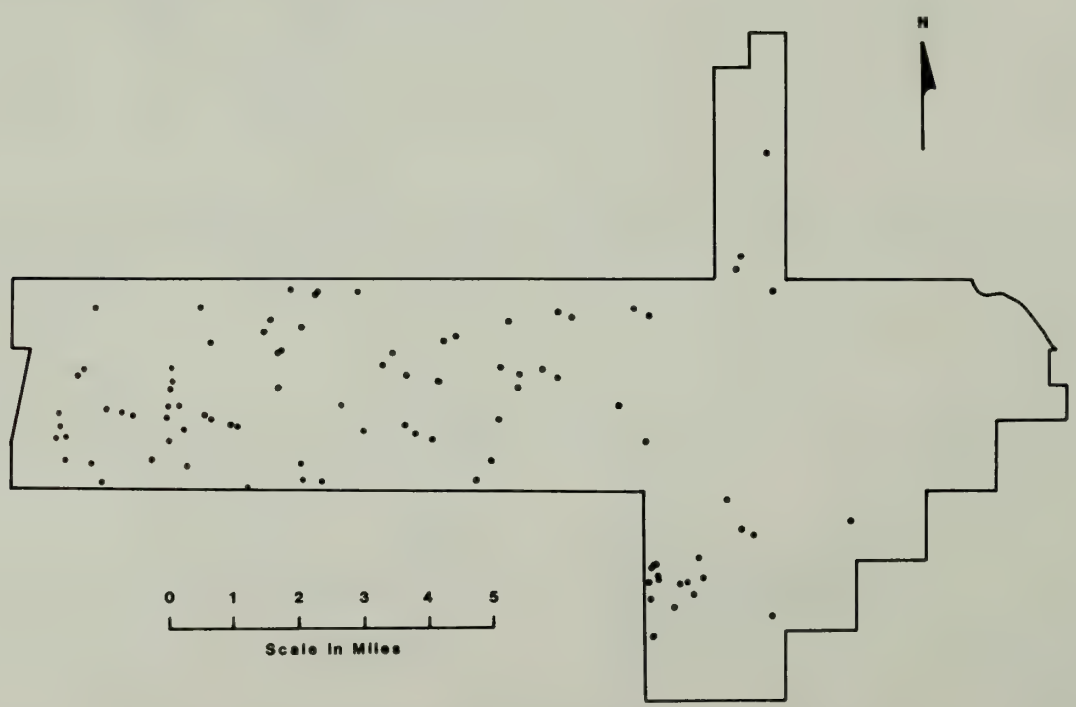


FIGURE 5.47. Wupatki National Monument, Sites with Functional Code = 2.

TABLE 5.63. Tree-Ring Dates from Wupatki National Monument.

```
108  7
109  0 (4 4 5 6 6 6)
110  3 6
111  0 1 8
112  0 0 0 5 5 6 8 8 8 9
113  0 0 0 1 1 1 2 5 6 6 7 7 7 7 7 7 7 8 8 8 8 9
114  0 1 3 3 3 4 4 5 5 5 5 5 6 6 6 6 7 8 8 8 8 9
115  0 1 1 2 3 3 3 3 5 5 5 7 8 8 9
116  0 0[0]0 0 0 0 0 0 0 0 0 0 1 1 1 2 3 3 4 7 7 7 7 7 8 8 8 8 8 8{9}
117  0 0 1 1 2 2 2 3 3 4 4 4 4 5 8 9
118  3{3}3 3 3 3 4 5 6
119  0 0 0 0 0 1 2 2[2]2 2 4 4 4 7 7
120  0 1 3 5 7 9
121  1 2 3 5
```

Dates enclosed with ( ) are from the Heiser Springs Pithouse site (NA 1754); with [ ], from the Citadel (NA 355); and with { }, from Nalakihu (NA 358). All other dates are from Wupatki Pueblo. Underlining indicates a cutting date.

TABLE 5.64. Decade-by-Decade Breakdowns of Tree-Ring Dates from Wupatki National Monument.

Decade	Total Dates	Cutting Dates
1080-1089	1	0
1090-1099	7	4
1100-1109	2	1
1110-1119	3	0
1120-1129	9	0
1130-1139	23	12
1140-1149	22	11
1150-1159	15	6
1160-1169	32	20
1170-1179	16	4
1180-1189	9	7
1190-1199	16	9
1200-1209	6	1
1210-1219	4	2

trends in the sample of tree-ring cutting dates with population trends previously identified. Standardizing again for a thirty-year interval and superimposing our Period dating scheme over the tree-ring dates, we observe the following trends. From a pre-eruptive total of zero, cutting dates rise in Peiod 2 (defined here as A.D. 1064 - A.D. 1129) to a rate of 2.3 per 30-year increment. There is a sharp increase in cutting dates during Period 3 (defined here as A.D. 1130 - A.D. 1219) rate falls by nearly 26% from the Period 3 rate, to 21.5 cutting dates per 30-year increment. Period 5, after A.D. 1220, is not represented at all in the tree-ring date record, either by cutting or non-cutting dates.

We realize that the use of tree-ring date totals as an index of population growth involves potentially dubious assumptions--that our "peak" population estimates and rates of cutting activity are measuring quite different phenomena, and that what we may actually be monitoring with these numbers are trends at Wuaptki Pueblo and not Monument-wide patterns. Nonetheless, it is intriguing to note some gross similarities in the tree-ring record and our population estimates. In both cases, there is a relatively small-scale occupation in Period 2, explosive growth in Period 3 , and a decrease in Period 4 levels when compared to Period 3. A key difference lies in the magnitude of increase from Period 2 to Period 3, with tree-ring evidence indicating a growth rate (1,261%) approximately twice as high as the rate observed from architectural spaces (536% to 600%).

If we may further stretch credulity by looking in detail at tree-ring dates, we observe that cutting activity begins in earnest in the A.D. 1130s and peaks in the A.D. 1160s. Cutting activity never again approaches the rate of the A.D. 1160s, and ceases altogether in the second decade of the A.D. 1200s. It should be noted that the tree-ring record appears to indicate that abandonment of the Monument had begun well before the onset of Period 5. Also, the lack of cutting activity from Period 5 may indicate that the Monument was completely abandoned well before our proposed Period 5 end date of A.D. 1275, perhaps shortly after A.D. 1220.

Ceramic Evidence

A second proposed check on our population figures is provided by counts of selected black-on-white ceramic types from sites with quantitative assemblage data (i.e., data types 1, 2, or 3; see The Data Base, above). Table 5.65 provides data on twelve Tusayan and Little Colorado White Ware types that might reflect relative intensity of

TABLE 5.65. Totals of Selected Black-on-White Types from Sites with Quantitative Assemblage Information (Data Types 1, 2, or 3).

B/W Type	Monument-wide Total	Wupatki Pueblo Only
Black Mesa	555	21
Holbrook Var. A	279	0*
Sosi	1,669	280
Holbrook Var. B	438	0*
Dogoszhi	1,356	169
Padre	410	0
Flagstaff	6,656	3,266
Walnut	2,712	611
Tusayan	657	2
Leupp	19	0
Wupatki	1,112	994
Kayenta	35	0

*Five sherds of "Holbrook" are reported (Colton 1946:59) without information on variety

occupation for Periods 2 through 5. Because many of these sherds were recovered from excavation of Wupatki Pueblo, Table 5.65 presents both the Monument-wide total and the contribution made by Wupatki sherds.

Assuming that cumulative totals of the twelve black-on-white types reflect in some fashion the relative intensity of occupation during different time periods, we may compare sherd deposition rates with identified population trends by counting ceramically dated architectural spaces. We begin with Monument-wide totals, including sherds for Wupatki Pueblo. For Period 2, we sum the totals for Black Mesa and Holbrook Variety A (834); for Period 3, Sosi, Dogoszhi, Holbrook Variety B, and Padre (2,873); for Period 4, Flagstaff and Walnut (9,368); and for Period 5, Tusayan, Leupp, and Wupatki Dates enclosed with ( ) are from the Heiser Springs Pithouse site (NA 1754); with [ ], from the Citadel (NA 355); and with { }, from Nalakihu (NA 358). All other dates are from Wupatki Pueblo. Underlining indicates a cutting date.(1,788). These assignments of types to periods generally reflect the ceramic-group scheme presented in Chapter 3, with the following exceptions. Padre Black-on-White, a Little Colorado white Ware type that is stylistically most similar to the Tusaysn White Ware type Dogoszhi Black-on-White is included in our totals for Period 3, and Wupatki Black-on-White is included in Period 5 under the assumption that this "local" type is stylistically most similar to Tusayan Black-on-White. The latter decision was based on two factors: (1) the majority of Wupatki Black-on-White sherds in the Monument-wide totals are from Colton's (1946a:59) counts from Wupatki Pueblo, and (2) the type specimens of Wupatki Black-on-White illustrated by Colton (1946a:21) appear to be stylistically identical to Tusayan Black-on-White.

Adjusting for a standard 30-year period, we observe the following trends for sherd totals. Period 2 has a deposition rate of 379.1 sherds; in Period 3, the rate rises to 3,873, a 1,022% increase; in Period 4, the rate increases by about 21%, to 4,684 sherds per 30-year increment; and in Period 5, there is a 79% drop, to 975.2 sherds. These figures differ from trends observed for architectural spaces in the following ways. First, the rate of increase from Period 2 to Period 3 is much higher (1,02% for sherds, compared to the 536% to 600% range calculated for architectural spaces). The Period 2 to Period 3 increase in sherds does, however, compare with the increase observed for tree-ring cutting dates (1,261%). Second, although architecturally based population estimates invariably decrease from Period 3 to Period 4 (by 7% to 30%, depending on the method of calculation), the rate of Monument-wide sherd deposition appears to increase from Period 3 to Period 4. Finally, it is interesting to note a Monument-wide total of 35 Kayenta Black-on-White sherds, a type which we have assigned to Period 6.

If sherd totals from all sites on the Monument except Wupatki Pueblo are examined, the following time-corrected totals are calculated: Period 2, 368.6 sherds; Period 3, 3,424, and increase of about 929%; Period 4, 2,745.5, a decrease of about 20% from the Period 3 rate; Period 5, 792 sherds, or a drop of about 61% from Period 4. These figures agree relatively well with the trends calculated from architectural spaces, in which we figured a Period 2 to Period 3 increase of 536% to 600%; a decrease in Period 4 ranging from 7% to 30%; and a continuing decline in Period 5, with peak totals 48% to 63% less than in Period 4.

Summary and Conclusions

In this section, we have estimated the prehistoric population of Wupatki National Monument by using several different methods and assumptions. We have also briefly examined spatial trends in settlement location and have checked our population estimates against two supplementary categories of evidence: tree-ring dates and counts of black-on-white ceramics. In general, we observed the following trends in population growth for sites fitting Functional Codes 1 and 2. From a resident population base of zero in pre-eruptive times, there is a rise during Period 2 to between 171 and 480 persons. The peak of Period 3 population shows a tremendous increase over Period 2, reaching a level of between 1,026 and 2,572 persons. The peak of Period 4 population falls somewhat, to between 954 and 1,860 persons. The decline accelerates during Period 5, which has a population peak of between 354 and 976 persons.

Tree-ring dates and black-on-white ceramic counts tend to corroborate these trends, with the following exceptions. Tree-ring evidence suggests a much steeper rate of population increase from Period 2 to Period 3, and there is no tree-ring evidence for construction activity during Period 5. The latter fact may indicate either that Period 5 commenced earlier than our inferred beginning date of A.D. 1220 or that Wupatki National Monument was not occupied very long after that date. The ceramic evidence differs from our population estimates by also indicating a much greater increase in population levels from Period 2 to Period 3. If counts of black-on-white sherds from Wupatki National Monument are included in calculating trends in ceramic deposition, population apparently increases from Period 3 to Period 4. If Wupatki is excluded, however, trends in ceramic deposition and inferred population changes generally agree--although again, a much higher rate of increase is indicated between Periods 2 and 3.

Synthesis and Research Recommendations

Pre-Eruptive Population

There is no evidence of a substantial pre-eruptive occupation or use of Wupatki National Monument. Only two of the 977 dated sites (0.20%) had a combination of decorated and undecorated sherds that securely placed them in the pre-eruptive period (Period 1). Sixty-two of the 1,970 sites known to have ceramics (3.1%) had pre-eruptive types, but these types comprised only 242 from a Monument-wide total of 104,101 sherds (0.23%). Precisely what the presence of 242 sherds at 62 sites signifies is not clear, but it may be concluded that, compared to the post-eruptive period, pre-eruptive occupation and land use were very small indeed.

Post-Eruptive Population Change

Colonization and Abandonment Date

It is clear that the vast majority of prehistoric activities on Wupatki National Monument took place from A.D. 1064 to A.D. 1275, and probably within a more restricted span, from about A.D. 1070 to a few decades after A.D. 1220. In fact, the most intensive occupation may have been shorter still, beginning after A.D. 1100 and terminating around A.D. 1220.

Evidence in favor of the latter estimate is found in the Monument-wide tree-ring

record and ceramic inventory. Tree-ring dates (Tables 5.63 and 5.64) show no cutting activity prior to the A.D. 1090s, and the first cutting date at Wupatki Pueblo is not recorded until A.D. 1106. Major construction at Wupatki appears not to have commenced until the A.D. 1130s (cf. Stanislawski 1963:40).

The ceramic record seems to support the tree-ring evidence by revealing no significant quantities of "eruptive" period or immediately post-eruptive types (e.g., Coconino Gray [n = 1], Medicine Gray [n = 74], or Deadman's Black-on-Red [n = 15]; cf. Colton 1946:81-84, 96-97; Sullivan 1986), and relatively few sherds of Black Mesa and Holbrook Variety a Black-on-Whites (Table 5.11). All of these types might be expected to occur in greater abundance if the Monument had been intensively occupied in the first one or two decades after the eruption.

The reasons for such a lag are unknown. Watson Smith, who also proposed that Wupatki National Monument had not been colonized until about A.D. 1100, suggested that the landscape may not have been attractive for settlement immediately after the eruption:

In all probability, . . . the area covered by the Sunset ash fall could not have been occupied at once, but must have remained desolate until its condition had become such as to entice the peripheral populations, attracted by the improved possibility of agriculture and the presence of water due to mulching effect of the ash fall that covered the basalt and limestone surface. How long this might have required I do not know--five, ten, twenty years perhaps?

On the other hand, settlement of Wupatki National Monument may not have been directly related to the effects of Sunset Crater ash. Pilles (1979:468-469) has suggested that climatic factors may have been more important than the eruption in attracting populations to lower elevations, such as Wupatki, in the early Twelfth century A.D. It is interesting to note that Baldwin and Bremer (1986:153; Bremer 1988:102, 198-199), also on ceramic evidence, have proposed an even more extended time lag (to ca. A.D. 1120) for the post-eruptive settlement of Walnut Canyon National Monument, in which the eruption's effects were presumably less pronounced.

Regarding the abandonment of Wupatki National Monument, it has been noted (see Prehistoric Population Levels, Table 5.64, above) that construction at Wupatki Pueblo seems to peak in the A.D. 1160s. A cutting date of A.D. 1160 from the Citadel (Robinson et al. 1975:38) provides a hint of construction activity there contemporaneous with major growth of Wupatki. A later cutting date of A.D. 1192 at the Citadel indicates continued construction or repair, perhaps also contemporaneous with similar activity at Wupatki (Table 5.63). It should be noted that the reported tree-ring date of A.D. 1260 from the Citadel (Douglass 1929:743; see also Colton 1946:52-53) never, in fact, existed. This date was the result of a typographical error involving specimen CIT-3, which is now securely dated at A.D. 1160 (Laboratory of Tree-Ring Research Site Files; Robinson et al. 1975:38). The latest tree-ring cutting date so far reported from the Monument is therefore from Wupatki, at A.D. 1212, and the very latest date (also from Wupatki) is not far ahead, at A.D. 1215.

The tree-ring record regarding abandonment is corroborated to some degree by ceramic evidence. The extreme scarcity of Period 6 (post-A.D. 1275) types (e.g., Kayenta Black-on-White [n = 35], Kiet Siel Polychrome [n = 12], and Kiet Siel Gray [n = 57]) suggests that the Monument had been largely depopulated well before the

onset of Period 6. Although there is some evidence for the use or occupation of Wupatki Pueblo during Period 6 (see Reed 1939), these activities were evidently quite limited. There is no evidence of Jeddito Black-on-Yellow (a post-A.D. 1300 type) from Wupatki Pueblo. The occurrence of this type in Room 7 that was reported by Colton (1946a:59) was the result of an erroneous transcription of Jeddito Black-on-White totals given by Reed (1939).

Population Trends

We have inferred that Period 3 (A.D. 1130 to A.D. 1160) was the time of most rapid population growth and that peak population in this interval reached a level about five to twelve times the peak of that in Period 2. The peak level of Period 4 seems to have declined somewhat for Period 3, and the Period 5 peak shows a rather precipitous decline. We cannot yet say precisely how the population changed between and within these arbitrary intervals. If tree-ring cutting dates are in fact a proxy measure of population trends (as previously noted, a potentially dubious proposition), it would appear that the population of Wupatki National Monument indeed rose sharply in the A.D. 1130s and that rapid growth continued into the A.D. 1160s. What the tree-ring record indicates over the next five decades is less clear, but the growth rate of the preceding four decades does not appear to have been sustained. Given the possibilities that cutting dates might signal either the construction of new rooms or the maintenance of existing ones (provenience information from Wupatki Pueblo does not at present allow the distinction to be made), equally plausible arguments might be made for a slow decline of population throughout the period or a relatively rapid decline after A.D. 1200.

Cultural Affiliations

We have noted the problematic nature of inferring prehistoric cultural affiliations and have exercised caution in our interpretations of the undecorated assemblages of Wupatki National Monument. Many previous inferences regarding Wupatki-area assemblages (e.g., Colton 1946a:49-50, 52-63, 128-131, 204-206; 1968; King 1949:142, 145-147; Smith 1952:166-178), based on large samples of excavated ceramics and stratigraphic evidence, cannot be evaluated using surface evidence alone. Furthermore, because many issues in the exchange and use of Flagstaff-area ceramics are unresolved, the cultural or ethnic significance of ceramic assemblages is open to legitimate debate.

Nonetheless, we have offered these preliminary observations. First, the undecorated ceramic assemblages at Wupatki National Monument are dominated by Tusayan Gray Ware. Whether this fact indicates that settlement of the Monument was primarily by "Anasazi" populations or that Tusayan Gray Ware was simply the preferred trade ware at the northern periphery of the Flagstaff area is difficult to ascertain. It is interesting, however, to compare the Monument-wide sherd counts from Wupatki with those presented by Baldwin and Bremer (1986:134-135) for Walnut Canyon National Monument. Excluding the large excavated ceramic sample from Wupatki Pueblo (22,130 undecorated sherds), the ware breakdowns from Wupatki National Monument (n = 9,830); Tusayan Gray Ware, 59.1% (n = 27,360); San Francisco Mountain Gray Ware, 16.5% (n = 7,650); and Prescott Gray Ware, 1.8% (n = 843). (If Wupatki counts are included, the Monument-wide percentage of Alameda Brown Ware rises to 37.4% and Tusayan Gray Ware, San Francisco Mountain Gray

Ware, and Prescott Gray Ware drop to 48.3%, 11.7%, and 1.6%, respectively.)

This pattern contrasts sharply with data from Walnut Canyon, where Alameda Brown Ware accounted of 92.7% (n = 6,470) of all undecorated sherds (n = 6,983). Tusayan Gray Ware composed only 5.7% (n = 398) of the assemblage, and San Francisco Mountain Gray Ware only 1.6%(n = 111). Prescott Gray Ware was not reported.

Although the occupation of Walnut Canyon may have persisted slightly later than the occupation of Wupatki National Monument, the settlement systems are basically contemporary. Thus, a major difference in undecorated assemblages is documented over a distance of only a few kilometers. We suggest that this variability may be due not to exchange, but to different source populations for settlement of the Walnut Canyon and Wupatki areas. While Walnut Canyon may have been settled primarily by people from the immediate Flagstaff area, we propose that Wupatki National Monument may have been settled largely by Kayenta Anasazi populations, originating, perhaps, from the Black Mesa area to the northeast. Portions of this area were depopulated at approximately the same time that the Monument population experienced its greatest rate of increase (Powell et al. 1983:233). A post-A.D. 1130 Kayenta influx for Wupatki National Monument was also identified by Smith (1952:94, 173) at sites in the Big Hawk Valley.

We have also noted, however, that a substantial number of ceramic assemblages characteristic of other traditionally defined prehistoric cultures are also present at Wupatki National Monument. Specifically, we have documented the existence of "Sinagua" (Alameda Brown Ware dominant) and "Cohonina" (San Francisco Mountain Gray Ware dominant) assemblages. We have also documented that these assemblages are not evenly distributed across the Monument, as appears to be the case for sites dominated by "Anasazi" ceramics (Figures 5.23, 5.24, and 5.33). The pattern is not exceedingly robust, but "Sinagua" assemblages appear most heavily concentrated around Wupatki Pueblo and along the southern boundary of the Monument (Figures 5.26, 5.27, and 5.34). (Wupatki Pueblo, of course, has traditionally been classified as a "Sinagua" settlement on the basis of its undecorated assemblage, which is about 71% Alameda Brown Ware.) "Cohonina" sites appear to be concentrated mostly in the far western portion of the Monument (Figures 5.29 and 5.35). Ceramically "mixed" sites (Figures 5.32, 5.36, and 5.37) generally overlap with the distributions of "Sinagua" and "Cohonina" sites, and there is some indication that these sites tend to date to the earlier portion of the Monument occupation sequence.

Site Functions and the Wupatki Settlement System

In this study, we have attempted formal and functional classifications of the various prehistoric sites of Wupatki National Monument. For sites lacking architectural remains, we proposed nine categories (Descriptive Summary of Site Types and Site Characteristics): (1) artifact scatters; (2) agricultural sites; (3) reservoirs; (4) cist, hearth, or upright-slab feature sites; (5) building-stone quarries; (6) shrines; (7) petroglyph sites; (8) burial sites; and (9) isolated artifacts of special significance. Of far more importance to settlement analysis are sites with architectural remains, which we classified (A Functional Typology of Wupatki Sites, above) according to four Functional Codes: (1) habitation sites; (2)

sites with a probable habitation function; (3) sites of unknown function that may have served either a habitation or specialized activity function; and (4) "field-house" sites, or simple, small structures inferred to have been used as shelters during agricultural activities or resource-gathering expeditions. In the discussion that follows, we will attempt a brief synthesis of ways sites in the last four categories might have functioned in a system of settlement and land use during the Twelfth and thirteenth centuries A.D.

Patterns of Settlement

If sites fitting functional codes 1 and 2 (n = 345) may be accepted as settlement locations, we observe that major settlement districts on Wupatki National Monument evidently arose in tow places. One of these surrounded Wupatki Pueblo, and the second was centered on the Citadel (Figures 5.21, 5.46, and 5.47). The major ruins in the first district are Wupatki Pueblo and the Campground Ruin (the first and third largest sites on the Monument; see Descriptive Summary of Site and Site Characteristics, above), and in the second, the Citadel (second largest) and four of the remaining ten largest sites: WS 1636, WS 1723, WS 142, and WS 1556. A third set of large sites at the far northern end of the Monument (Figure 5.21) may in fact not represent a settlement center. One of the sites is Crack-in-Rock Pueblo, an unusual and possibly special use structure (Colton 1946a:68-69; Smith 1952:70-76), and the other is a set of dispersed rooms scattered along the top and sides of Horseshoe Mesa, a major petroglyph locality.

Individually, sites within the Wupatki and Citadel settlement districts appear to represent what Wilcox (1986:30) has called "hamlets" (nine to twenty rooms) or "small nucleated villages" (25 to 100 rooms). Together, along with numerous smaller surrounding settlements, they compose substantial population aggregates that probably numbered several hundred people during the peak of occupation in Periods 3 and 4. On this basis, it may be presumed that the Wupatki and Citadel settlement districts were the dominant economic and political entities of the Monument area during the Twelfth and early Thirteenth centuries A.D.

Settlement of the Monument was certainly not confined to the Wupatki and Citadel districts, however, as Figures 5.18, 5.19, 5.21, and 5.47 show, there were numerous small pueblos (20 rooms or less) and pit-house sites in a variety of settings. The Big Hawk Valley and Antelope Prairie appear to have been heavily and rather evenly populated with such settlements. Pit-house sites (Figures 5.18 and 5.19) appear to be most concentrated in the Big Hawk Valley west of the Citadel. There is an interesting band of small settlements (seven to 10 architectural spaces) in the Big Hawk Valley along the southern Monument boundary (Figure 5.21), and another potentially significant distribution of sites occurs at the interface of Antelope Prairie and the Wupatki Basin, where a band of settlements stretches along the Antelope Cliffs. Many of the latter sites are small pueblos, situated at the entrances to canyons that lead from the basin to the central portions of the prairie. The strategic location of these sites is intriguing, and suggests that they might have figured in defining territories or in regulating the movement of people or commodities between Antelope Prairie and the Wupatki Basin.

"Field-House" Sites and Off-Settlement Activities

By far the most abundant category of site on Wupatki National Monument is the

small "field-house" or "enclosure" site (Functional Code 4; n = 1,731), which accounts for 72% of all prehistoric sites and 78% of all sites with architecture. As discussed in A Functional Typology of Wupatki Sites, above, these sites are inferred generally to represent the remains of small structures used on a temporary basis during the performance of agricultural tasks or short-term resource-gathering expeditions. These sites are widely and rather evenly dispersed and occur in all portions of the Monument (Figures 5.16 and 5.17 depict the locations of enclosure sites and isolated masonry-room sites, which account for most Functional Code 4 sites).

Discussions of the agricultural systems of Wupatki National Monument are presented elsewhere (Marozas 1983; Travis, this volume), and we will not attempt an assessment here. We note, however, that in addition to the extremely high densities of agricultural features (e.g., alignments, terraces, rock piles, and check dams), the abundance of "field-house" sites may be yet another index of the significance of agricultural activities on the Monument in the Twelfth and Thirteenth centuries A.D. The sheer volume of such sites is quite impressive, and could imply a great deal about the nature of prehistoric agriculture in the Wupatki area. If we are correct in our estimates of the span of Monument occupation (approximately 120 years), then new "field-house" sites were created at an average rate of more than 14 per year (1,731/120). The construction of such sites was not evenly distributed through time, however, and at the peak of occupation the rate must have been many times higher. This fact, and rather meager artifact inventories, suggest an exceedingly limited use-life for field houses, which may in turn imply a relatively fast depletion of Wupatki-area soils or an exceptionally extensive and flexible system of plot rotation. Whatever the case, future attempts to model Wupatki-area agricultural systems should make full use of the data that are provided by this category of site.

Summary and Conclusion

The settlement and subsistence systems of Wupatki National Monument were relatively small-scale but potentially complex. Two major "settlement districts" have been identified in the Wupatki and Citadel areas, but the landscape between and beyond these districts appears to have been extensively settled and used for agricultural activities. Given the distribution of springs and live streams, the procurement of domestic water must have been a major concern for most residents. The Wupatki settlement district was located near several reliable springs, but settlements in all other areas were probably dependent on a system of wet-weather ponds or shallow reservoirs and daily trips to area springs or the Little Colorado River (Ritterbush 1984). Such trips may have involved distances of 15 km or more.

This seemingly paradoxical settlement system is rendered less so if it is presumed to have been motivated primarily by agricultural pursuits. In this regard, the effects of Sunset Crater ash fall might have been quite significant. Ultimately, the settlement of lower-elevation zones like Wupatki in the late Eleventh and early Twelfth centuries A.D. may well be attributable to regional climatic and cultural changes, as others (e.g., Pilles 1979:479-480; Wilcox 1986:38-42; Wilson 1969) have suggested. This does not, however, deny a local role to the eruption. Based on the evident size of the population, the aggregate of agricultural features, the number of "field-house" sites, and the apparently insignificant role of surface water in the location of many settlements, the

Wupatki area seems to have been particularly attractive to agriculturalists, perhaps because of the mulching effects of the Sunset Crater ash and cinders. This explanation receives additional support from the dendroclimatological record (Dean and Robinson 1977), which shows subnormal precipitation for the decades spanning A.D. 1120 to A.D. 1160, a time inferred to have seen the most rapid increase in Wupatki-area population. If these decades were particularly risky for corn farmers, the Sunset Crater ash and cinders might have provided a significant edge.

It seems reasonably clear, however, that productivity could not have been indefinitely sustained. The Wupatki area is not endowed with great reserves of wild plant or animal foods or timber, and the shallow soils of Antelope Prairie and other upland zones appear to offer a fragile medium not well-suited for extensive cultivation and other ground disturbance. Thus, it is easy to propose that environmental degradation, brought about by the food, fuel, and timber requirements of perhaps more than 2,500 people (Prehistoric Population Levels, above), played the most significant role in the abandonment of Wupatki. Whether this was in fact the case awaits detailed analyses of macrofloral, pollen, and other evidence not now available.

Finally, we have said little so far concerning the possible social and political structures that might have arisen during the course of the prehistoric occupation. We note simply that there are some indications that the Monument was settled by populations from different areas, and that there is no reason to presume the arbitrary boundaries of Wupatki National Monument enclosed a unified polity or other cooperative unit. Intriguing architectural and material-culture differences exist between the Wupatki and Citadel settlement districts (e.g., in undecorated ceramic assemblages and in the presence of a ball court at Wupatki), and these could conceivably signal ethnically different and perhaps competing population aggregates. There is evidence of prehistoric violence from excavated sites on the Monument (e.g., Smith 1952:20, 25, 61-62, 67-69, 179-180, 187; Stanislawski 1963:54, 58), and some architectural forms (e.g., the Citadel and Crack-in-Rock Pueblo) appear to represent fortifications (see also Baldwin and Bremer 1986:108-117; Bremer 1986:202-203; Wilcox 1986:41-42). We have also noted the presence of small pueblos that appear to "guard" access to the canyons that lead from the Wupatki Basin to Antelope Prairie. None of this indicates anything conclusive about inter-settlement relations or the role of conflict in settlement processes, but we suggest that future research proceed without the bias that all prehistoric sites on the Monument functioned in a single, cooperative settlement and subsistence system.

Research Recommendations

Our research recommendations are brief. Throughout this report, we have indicated weaknesses in our data base and analytic techniques and have offered suggestions as to how our inferences might be tested through collection of additional data and evaluation of our assumptions. In this section we offer a few observations regarding possible future research directions.

First, we recommend that the maximum data be extracted from projects already completed. More than 50 years have passed since the first excavations of Wupatki Pueblo by the Museum of Northern Arizona, but to date this work remains incompletely reported, and adequate specialized analyses have never been done.

Likewise, many other efforts, such as the Wupatki Ballcourt excavations and several stabilization efforts of the 1950s and 1969s, remain unanalyzed, unreported, or both. We suspect that a great deal remains to be learned from these field operations, and we urge no further excavations until the collections from previous field studies have been adequately documented and analyzed.

There is no question, however, that additional fieldwork will someday be required to resolve many of the most important research issues in the prehistory of Wupatki National Monument. At the head of the list are issues of site function, chronology, subsistence, ceramic manufacture and exchange, environmental change, paleodemography and paleopathology, and inter-settlement relationships. The specific plan of studies designed to address these issues is beyond the scope of this report, but we recommend that whatever research strategy is adopted make full use of the data base provided by the Wupatki Survey. The great strength of a complete inventory survey lies in an ability to document the full range of variability in surface attributes of sites within the study area. Variability may then be stratified, and sites grouped into sets from which samples can be systematically extracted for more detailed study. We believe that the present study has made a start in stratifying variability among the prehistoric sites of Wupatki National Monument, and we look forward to future studies that will test the propositions that we have advanced.

Management Recommendations

Our recommendations for the management of prehistoric archaeological resources are brief and heavily oriented toward preservation. This position derives from a belief that an enhanced understanding of the prehistory of Wupatki National Monument will depend on detailed studies of all site types, ranging from the largest pueblos to the most diffuse artifact scatters. This implies that all sites, regardless of size or complexity, should be protected from adverse impacts due to vandalism, casual artifact collection by visitors, and livestock grazing.

We argue that no site is "safe" in terms of unrestricted visitation. As this study has demonstrated, the majority of prehistoric sites at Wupatki National Monument are quite small and have exceedingly restricted inventories of surface items. There is no guarantee that such sites will yield subsurface remains. Many are located in upland settings that have no significant accumulations of potentially artifact-bearing sediments. Furthermore, because the total number of items actually used at the sites was undoubtedly small, surface assemblages cannot be regarded as expendable and replicated by possible subsurface artifacts. Surface and subsurface assemblages must be regarded as complementary data sets, each of which may provide irreplaceable clues to site functions, seasons of occupation, and dates. Unfortunately, a single incident of unauthorized artifact collection by visitors can forever remove the critical information that could be gained from surface artifacts. Thus, we cannot support the notion of unsupervised visitor access to backcountry ruins, even on a permit basis.

Neither do we support renewed grazing under any circumstances. There is no portion of the Monument that is sufficiently free from prehistoric sites to justify the practice. We suspect that many ruins, particularly those along the northern margins of Antelope Prairie, have been seriously damaged by past grazing. Livestock have

trampled and broken surface artifacts and knocked down standing pueblo walls, and a variety of impacts have resulted from the vehicles and facilities used to transport, feed, and water the livestock. All of these factors hamper the classification and interpretation of cultural resources. Particularly, the breakage of surface potsherds into small, unidentifiable pieces constrains our ability to date the sites, and the reduction of visible walls to rubble mounds prevents accurate counts and measurements of structures and rooms.

While the Wupatki Survey has done an admirable job of locating and characterizing the prehistoric archaeological resources of the Monument, we have made only the most tentative progress toward understanding the events and processes that occurred there in the Eleventh, Twelfth, and Thirteenth centuries A.D. The prehistoric settlement, subsistence, and social systems of Wupatki remain enigmatic in many ways, and we suspect that many unexpected conclusions will be forthcoming from future research. The Wupatki Survey was, after all, designed primarily to inventory the archaeological resources of the Monument, and not to conduct the type of detailed studies that will now be required to resolve unanswered questions about chronology, cultural affiliations, subsistence practices, paleodemography, social organization, political structure, and a host of other research topics. Such studies should themselves be conducted deliberately and, to quote Dale King (1949:14), with the respect and care that is required when "tampering with a ruin on a national monument."

We conclude by cautioning against the notion that the Wupatki Survey has collected enough data from individual sites to allow unsupervised visitation or any other relaxation of protective measures. Rather, the survey should mark the beginning of a new era of archaeological research and public interpretation, one that is characterized by a much improved understanding of the variability inherent in the prehistoric sites of Wupatki National Monument and an increased respect for the fragility and value of that data base.

Chapter 6

NAVAJO ETHNO-HISTORY AND ARCHEOLOGY

by Alexandra Roberts

> . . . On one of these inspections we were accompanied by Clyde Peshlakai who pointed out each of the old Navajo hogans along the road and told us a bit about the history of each. Here was the hogan in which a baby had died and the family lived in this one nine years ago. Marked only be the door frame was the the hogan to which Peshlakai Etsidi brought his bride many years ago. . . . It is hoped that someday we shall have the brief history of each of these structures within the boundaries of the Monument, as it forms an interesting phase in the history of its occupation. --D. Jones, 1940

Introduction

This chapter presents a summary of the results of two seasons of ethnohistorical research among former and present Navajo residents of Wupatki National Monument. The chapter is divided into six parts: Methods and Procedures; Previous Research; Sharing Wupatki: A Century of Navajo/Anglo Relations; Changes in Navajo Land Use; An Inventory of Wupatki's Historic Archeological Record; and Future Management Concerns.

A primary goal at the outset of the project was to provide the Monument with an understanding of the historical context in which the Navajo archeological record was formed. The Wapatki Navajos are a distinct group of people, intimately tied to the Wupatki landscape and united by strong genealogical ties. The archeological sites which represent over a century of Navajo occupation in the Wupatki basin are considered not as isolated entities but as the material manifestations of a dynamic cultural whole. These archeological sites are physical links to a rich Navajo history--a history that continues through living people and is inextricably intertwined with the Monument itself.

In providing a cultural historical reconstruction of the Navajo occupation of Wupatki, several ends are met. Primarily, identification of historically and religiously significant sites within Monument boundaries will aid the National Park Service (NPS) in addressing long-term management concerns. Proper management decision-making may significantly strengthen NPS/Navajo relations, setting a precedent for interactions between the National Park Service and the Navajo Nation, which controls 16 million acres surrounding several southwestern National Parks and Monuments. Historical research will also provide the NPS and the general public with written accounts of the history of Navajo occupation of the Wupatki region. Cultural historical documentation is further intended to provide a springboard for ethnoarcheological analyses of site structure, which is a secondary goal of the project. The relatively pristine nature of the Navajo archeological record and the well-defined extent of the land-use system provide an ideal data base for the application of specific ethnoarcheological analyses. The pursuit of these goals reflects the original scope of the project as envisioned by the NPS through several years of planning and management documentation.

Administrative Background

Recommendations for the collection of Navajo oral history at Wupatki were first presented in 1977 in the Archeological Assessment of Wupatki National Monument (Hartman and Wolf 1977). The study was subsequently identified as Project C2 in the 1981 Resource Management Plan and was further supported by Management Objective #4 of the Statement for Management. Specific guidelines for the proposed study were outlined in a 1982 Development/Study Package Proposal, "In order to satisfy mandates under the American Indian Religious Freedom Act of 1978 and the National Historic Preservation Act of 1966." Of more immediate concern to Wupatki itself, however, was the fact that a limited number of Navajo individuals were permitted to graze sheep within the basin. It was recognized, therefore, that

> . . . more information is needed to understand the Navajos and their special relationship with the land. Living cultures change through time. This evolution should be recognized and documented to assist management in working with these people. Site specific information is needed to assist an on-going archeological survey (begun in 1981) in recording historic sites, to provide data for planning teams, to improve interpretation of living cultures, and to allow better management decisions. A historical study utilizing historic documentation, detailed informant information and an oral history from Navajo people living within the Monument would assist managers and cultural resource specialists in developing policy regarding the Navajos (NPS 1982).

The project was originally intended to run concurrently with the Wupatki Archeological Inventory Survey (Package 117--Park General--5-year project) beginning in 1981. Seven years after the "Ethnohistoric Study for Navajo Culture" had been identified as a need in numerous planning documents, however, it remained without funds. Instead, the project was subsumed into the on-going Archeological Inventory Survey Project. Both the scope of work and the ethnohistorical research budget were significantly reduced in order for the entire project to be completed by a single researcher in two field seasons. The original objectives of the project may now be re-evaluated in light of what was feasible to

complete in two field seasons. The two seasons of field work involved a literature search and an interviewing program, respectively. The methods employed during both stages of research are discussed below.

Methods And Procedures

Phase I

Phase I of the Wupatki Ethnohistorical Research Project began in May 1984 with an orientation to the field procedures of the archeological survey, organization of the Navajo archeological data recorded as of 1984, and location and review of all archival materials and administrative documents relating to the historic occupation of the Monument. Archival research began with materials on file at Wupatki and led to files housed in Albuquerque, Santa Fe, Window Rock, Tuba City, Flagstaff, and Phoenix. The specific sources consulted are listed in Table 6.1. It should be noted that budgetary constraints precluded a search for information in the National Archives and GSA Records Centers.

Preliminary interviewing began with the Navajo family residing on the Monument, primarily for clarification and updating of existing genealogical data. Specific Navajo individuals were also identified for the interviewing program to be initiated during Phase II, and a few initial site-specific interviews were conducted. Extensive correspondence was initiated with current and former NPS employees familiar with the Navajo history of the Monument, and interviews were conducted with several of these individuals. The final weeks of the season were spent with Dr. Jeffrey S. Dean, Professor of Dendrochronology, University of Arizona, collecting 100 tree-ring samples

TABLE 6.1. Information Sources Consulted During Phase I (1984).

I. Archival Collections:
- A. Wupatki National Monument
  - 1. Photo and textual archives
    - a. See Bibliography
  - 2. Administrative documents
    - a. Grazing files
    - b. Black Falls Trading Post files
- B. Museum of Northern Arizona, Flagstaff, AZ
  - 1. Photo files
    - a. MS-242
    - b. MS-101
  - 2. Textual files
    - a. MS-162
    - b. MS-113
    - c. MS-14
- C. Coconino County Clerks Office, Flagstaff, AZ
  - 1. Land status records
    - a. Register of Deeds
    - b. Register of Mining Claims
    - c. Register of Water Rights
- D. Laboratory of Anthropology, Santa Fe, NM
  - 1. Navajo land-claim site reports
- E. Zimmerman Library, University of New Mexico, Albuq.
  - 1. Government Publications
    - a. U.S. Commissioner of Indian Affairs, Annual Reports 1857-1911. Washington, D.C.: U.S. Government Printing Office.
  - 2. Anderson Collections
    - a. Indian Claims Commission, Proposed Findings of Fact in Behalf of the Navajo Tribe, etc. (Docket 229).
  - 3. General Collections
    - a. See Bibliography
- F. Western Navajo Agency, Tuba City, AZ
  - 1. Property Management Office
    - a. Allottment records
- G. Law Offices of DinebeiinaHahiilna BeAgaditahe, Tuba City
  - 1. Records of 1960s/1970s Litigation
- H. Law Offices of Brown and Bain, Phoenix, AZ
  - 1. Soil Conservation Service Human Dependency Survey Data, District 5

II. Interviews
- A. Navajo residents of Wupatki
- B. Non-Navajo former residents of Wupatki
  - 1. Mrs. Sallie Brewer Harris
    Prescott, AZ
  - 2. Dr. Robert Euler
    Grand Canyon, AZ
  - 3. Mr. Preston Mercer,
    interviewed at Wupatki
  - 4. Mr. and Mrs. David Jones
    Santa Fe, NM
- C. Administrators
  - 1. Mr. Richard Heiser
    Director of Cultural Resources
    Navajo Nation
    Window Rock, AZ
  - 2. Dr. Klara Kelley
    Ethnoarchaeologist
    Navajo Nation Cultural Resources Management Program
    Window Rock, AZ
  - 3. Ms. Martha Blue
    Attorney at Law
    Ward and Blue
    Flagstaff, AZ
  - 4. Mr. David Brugge
    Regional Curator
    Division of Interpretation
    NPS-SWR, Santa Fe, NM

III. Correspondence
- A. National Park Service
  - 1. Mr. Keith Anderson
    Director of Archaeology
    Western Archaeological Center
  - 2. Mr. William Everhardt
    Alumni Editor, Courier
    NPS Newsletter
  - 3. Mr. Tom Durant
    Picture Librarian
    Div. of Reference Services
- B. Former Wupatki Employees
  - 1. Mr. Harry Townsend
  - 2. Mr. Coytt Hackett
  - 3. Mr. William Bullard
  - 4. Mr. Phillip Van Cleve
  - 5. Mr. Albert Schroeder
- C. Non-NPS
  - 1. Ms. Sharon Debowski
    Paralegal
    Brown and Basin
    Phoenix, AZ
  - 2. Dr. Scott Russell
    Anthropologist
    Arizona State University
  - 3. Mr. Charles Carroll
    Anthropologist
    Bureau of Land Management
    Albuquerque, NM

from approximately 20 Navajo archeological sites for dendrochronological dating.

By the conclusion of Phase I at the end of August 1984, the majority of background and organizational work was completed. The primary task that remained to be undertaken during Phase II was an interviewing program, in order to collect oral history on a site-by-site basis.

Phase II

Phase II research was undertaken between May 13 and August 21, 1985, concentrating on ethnographic data collection. The interviewing program was initiated by compiling a portable photographic file of Navajo archeological sites from the Wupatki photo archives, the 1981-1984 archeological survey photo files, and a personal photo collection from the 1984 season. The portable photographic file was to be used in preliminary meetings with potential interviewees in order to identify at the outset the sites with which people were familiar. This procedure saved a considerable amount of time in the fieldwork stage, as it was possible to proceed directly to previously identified sites.

The services of Mrs. Helen Davis were secured as primary interpreter. The next step was to begin locating individuals by driving, often repeatedly, to their homes and establishing appointments for interviews in their homes and/or field trips to Wupatki. Most people were located on Grey Mountain, near Grey Mountain Trading Post, or near Cameron. Others were east of the Little Colorado River between Cameron and Leupp, and in Leupp, Tuba City, and Flagstaff, roughly a 2,400 square-mile area. Twenty-six individuals, either directly or indirectly related to occupation in Wupatki, were contacted between May 22 and July 23. Of these 26, interviews and/or site tours were conducted with 17 people on 24 occasions. In addition, Mr. Phillip VanCleve, former acting superintendent of Wupatki, was interviewed in his home in Carlsbad, New Mexico, on August 19 and 20, 1985.

Upon establishing contact with a particular individual, the general procedure was first to interview the person in his or her home, placing the person in historical, genealogical, and geographical context within the Monument. While no formal interviewing format was employed, questions were asked regarding such matters as the individual's genealogical affiliations, relative dates of residence on the Monument, historic events occurring during residence on the Monument, locations of residence, nature of seasonal mobility while living on the Monument, locations of primary water sources, and locations of other families residing on the Monument. These questions were aided by the use of the photo file, a base map of the Monument with all Navajo archeological site locations plotted on it, and the genealogical chart constructed during Phase I. Mrs. Davis interpreted the conversations as I took notes. On several occasions the interviews were taped. Each interviewee was then asked if he or she would accompany Mrs. Davis and me to Wupatki for more site-specific interviewing. Twelve individuals consented to such interviews.

Interviews on the Monument involved driving to or as close to the individual's former residences as possible or walking to sites, then asking questions regarding use of the site such as season of use, length of occupancy, number of individuals using the site, use of other sites during occupancy, and use of water sources while living at the site. The age of some interviewees and road

restrictions imposed by the Monument precluded visits to several of the more remote sites. For the most part, interviews were performed with one or two individuals per field trip. One seven-hour field trip included five elderly women due to their requests to go together, and in the hopes that a group trip would trigger the recall of otherwise forgotten past events. While the group trip did serve to spark a great deal of conversation, it was extremely difficult for even two interpreters to keep up with the cross conversations. Trips are probably most efficiently conducted in groups of three or fewer.

During the two months of the interviewing process, approximately 80 actual person-hours were spent in interviews (in addition to 57 hours of interpreting time). Roughly 50% of the remaining hours were spent in locating people and the other 50% in transcribing notes, summarizing information, correcting errors in information, updating genealogical information, photographing sites, and checking sites located by the archeological crew.

The data collected during the Phase II interviewing process were added to the information gathered during the literature search of Phase I, which had resulted in the compilation of previous documentation of the Wupatki Navajos recorded by various individuals during the last century. These records provide the framework around which to reconstruct history; therefore, a brief discussion of them precedes the historical sketch.

Previous Research

Perhaps the earliest substantial documentation of the Wupatki Navajos followed the establishment of the Tolchaco Mission by Reverend William R. Johnston in 1900. This Christian mission was built on the Little Colorado River, roughly 20 miles south of what is now Wupatki. Johnston recorded the activities of the Little Colorado River Navajos largely for the production of A Neglected People, the quarterly newsletter of Tolchaco Mission that was published by the Mission to the Navajo Indians, Kansas City, Kansas. While Johnston's interest in the local people was primarily religious, it was also humanitarian, and he described living conditions, health, subsistence, and seasonal mobility. Due to Johnston's efforts to protect the indigenous population from the encroachments of Anglo cattle ranchers in the early part of the century, federal attention was drawn to the area and additions were made to the Reservation along the Little Colorado River. The presence of federal Indian Affairs administrators in Tuba City and Leupp around the turn of the century contributed to documentation of the Navajo population along the Little Colorado River including information concerning numbers of people, availability of water, agricultural potential of the area, and economic conditions (U.S. Commissioner of Indian Affairs 1897, 1904).

It was not until the arrival of Wupatki's first custodians, however, that a historical interest in the local Navajos was generated. Jim and Sallie Brewer arrived at Wupatki in 1934, immediately establishing friendships with the Navajo families residing in the basin. During the next two years of their tenure in Wupatki, the Brewers prolifically recorded life with their Navajo neighbors. In addition to photographs, diaries, entries to the Southwestern Monuments Monthly Narrative Reports (SMMNR), and extensive genealogical information, Sallie recorded one of the most detailed accounts of the Long Walk in existence (Brewer 1937).

An affinity with the Navajo residents and an interest in recording the details of daily life was carried on by the Brewers' successors, David and Corky Jones. During the Joneses' custodianship in Wupatki between 1937 and 1949, detailed entries to the Monthly Narrative Reports continued to be made, and Corky published accounts of her experiences in learning how to weave on Navajo looms (Jones 1940). It was also during the 1930s and 1940s that numerous accounts of the Wupatki Navajos were written by Phillip Johnston (1939, 1942), son of the missionary, William Johnston, and by Richard Van Valkenburgh (1941, 1947a, 1947b), who had worked on archaeological excavations at the Monument and recorded his first experiences among the Navajo people.

Johnston, with his wife, Bernice, returned to Wupatki during the 1930s to aid in restoring traditional lands to the Wupatki Navajos that had been lost to private interests. They conducted considerable research into the federal acquisition and loss of certain lands north of the current Monument boundaries, and provided valuable historical documentation in the process. After his experiences at Wupatki, Van Valkenburgh, as an employee of the Office of Indian Affairs, continued to conduct research among the Navajos for the remainder of this life. In 1941 he published Dine Bikeya, one of the most frequently cited studies of Navajo place names in existence. He went on in the 1950s to conduct land-claims investigations throughout the reservation, including the Wupatki area. The land-claims studies, conducted by Van Valkenburgh and assisted by David Brugge, Harry Townsend, and Clyde Peshlakai, identified the earliest known Navajo sites in the Wupatki area, including several predating the Fort Sumner incarceration of 1864-1868.

Additional residential sites were identified within the Monument boundaries in 1952 by William Bullard, who conducted a photographic inventory of 12 sites. The photo documentation serves as a valuable baseline in monitoring site deterioration over a 35-year period. While Bullard did not plot his exact site locations, the locations of some of these and a few additional sites were plotted by Coytt Hackett, husband of superintendent Marjorie Hackett, in 1979. Hackett undertook the preparation of a historical atlas, a series of baseline maps upon which he plotted the history of the Monument's land status, habitation site locations, and historic roads and trails. As stated by Hackett in his preface to the atlas:

> It is hoped that others will utilize this atlas as a place to record 'discoveries' and other historical information, observations, etc. for the edification of those who come after. One immediate project would be to photograph old Navajo occupation sites and accurately map them. Certainly many are now historic and should be of increasing interest and value. Who lived there might be learned while the information is still known (1979).

Hackett's farsightedness certainly did lend to the edification of those who came after.

Perhaps the most concerted research efforts by Monument employees came during World War II, with the preparation of an extensive genealogy by acting superintendent Phillip F. VanCleve and a subsequent economic study by seasonal ranger Robert Euler. VanCleve thoroughly documented the consanguinial, affinial, and clan relationships of 112 individuals related to the Navajo occupants of the Wupatki basin. Euler incorporated this genealogical material into his 1949 Master's thesis, An Economic Study of the Navajos in the

Wupatki Basin, Arizona. Euler's thesis analyzed the economic relationships among the major family groups in the basin at the time of the study and provided unparalleled documentation of the economic situation of the far-western Reservation during World War II.

These and other data were utilized for further historical, genealogical, and geographical research during the 1970s in the course of litigation instigated by local Navajo families for compensation of loss of certain lands. Navajo Nation land-claim cases also continued throughout the 1970s, resulting in reams of highly classified and inaccessible historical material. General historical information concerning Navajos in the Wupatki area was provided in Bernice Johnston's 1972 publication, Two Ways in the Desert, a historical account of the Tolchaco Mission. In 1977, The Archeological Assessment of Wupatki National Monument (Hartman and Wolf) was produced, with a concise historical overview of the Monument.

These sources and numerous other popular articles produced over the years by interested employees and visitors have provided baseline data with which to reconstruct the culture history of the Navajo people of the Wupatki basin. A brief synopsis of this long and intricate history follows.

Sharing Wupatki: A Century of Navajo/Anglo Relations

The history of the Wupatki Navajos could be investigated from any number of perspectives, including those of economy, administration, and land use. None of these aspects of Navajo history, however, can be considered independently from Navajo relations with the Anglo population that came to share the desert during the last century. The course of nearly every facet of Navajo history since the last decades of the nineteenth century has been shaped by the dominant presence of Anglos surrounding Navajo land. The Navajo archaeological record reflects the changes in material culture and settlement patterns engendered by Navajo/Anglo interaction. The history of these relations in the Wupatki area is summarized briefly below, followed by a discussion of the changes in Navajo land use brought on by competition over limited resources.

The maternal sides of what would become the first permanent Navajo family of Wupatki subsequent to Fort Sumner were present in the lower Little Colorado River region by the early nineteenth century. According to Peshlakai Etsidi (Brewer 1937), original male settler of the Wupatki basin, his mother was born on Grey Mountain, placing the family in the area around 1825 (Ellis 1974:462). Peshlakai Etsidi's father's family was from the area of Pinon on Black Mesa (Figure 6.1), and it is possible that Navajo families traveled long distances to gather pinons in the high country surrounding the Grand Canyon, staying for several months during productive pinon years (Ellis 1974:462).

The maternal family of Baa', who would eventually become Peshlakai Etsidi's wife, was also well established in the Grey Mountain and Black Point areas since early in the nineteenth century. Baa' was born on Black Point in the early 1850s, and her mother, Asdzaan Ligai, was born on Grey Mountain (Peshlakai 1961, Robbins 1961) a generation before. Asdzaan Ligai's mother lived most of her life around Grey Mountain, and died there prior to 1864. Thus, the maternal side of what would eventually become Wupatki's founding family was present in the Grey Mountain area since at least the 1820s and perhaps earlier. Like Peshlakai

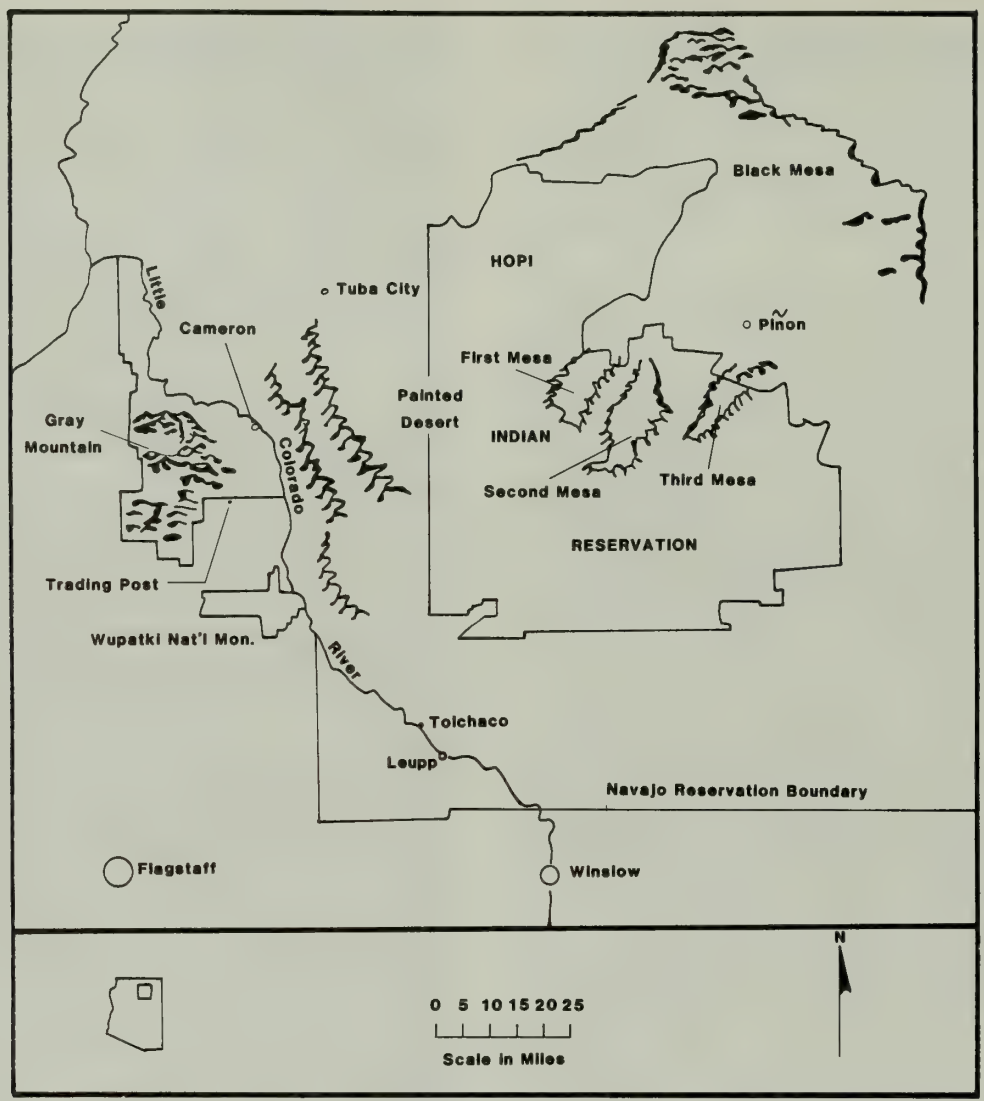


FIGURE 6.1. Regional Context of Wupatki National Monument, Arizona, with Geographic Locations Discussed in Text (from Roberts 1986).

Etsidi's family, Baa's maternal family also came from Black Mesa, and Adzaan Ligai had a sister who remained there during the Fort Sumner years. The family was prosperous, and reportedly had many sheep and cornfields at the time of Baa's birth. Whether the sheep and fields were retained on Black Mesa or were established on Grey Mountain by the 1850s is unclear, but it is likely that Grey Mountain was used for seasonal hunting and gathering prior to the 1860s. That the family was relatively wealthy, however, is supported by the fact that Baa's sister became the wife of Henry Chee Dodge, the first elected chairman of the Navajo Nation (Johnston 1939).

Prior to his death in 1939, Peshlakai Etsidi stated that his father and other Navajos had come to Grey Mountain from Pinon "over 100 years ago" and lived with the Havasupais (Van Valkenburgh 1941:42). His statement suggests initial occupation in

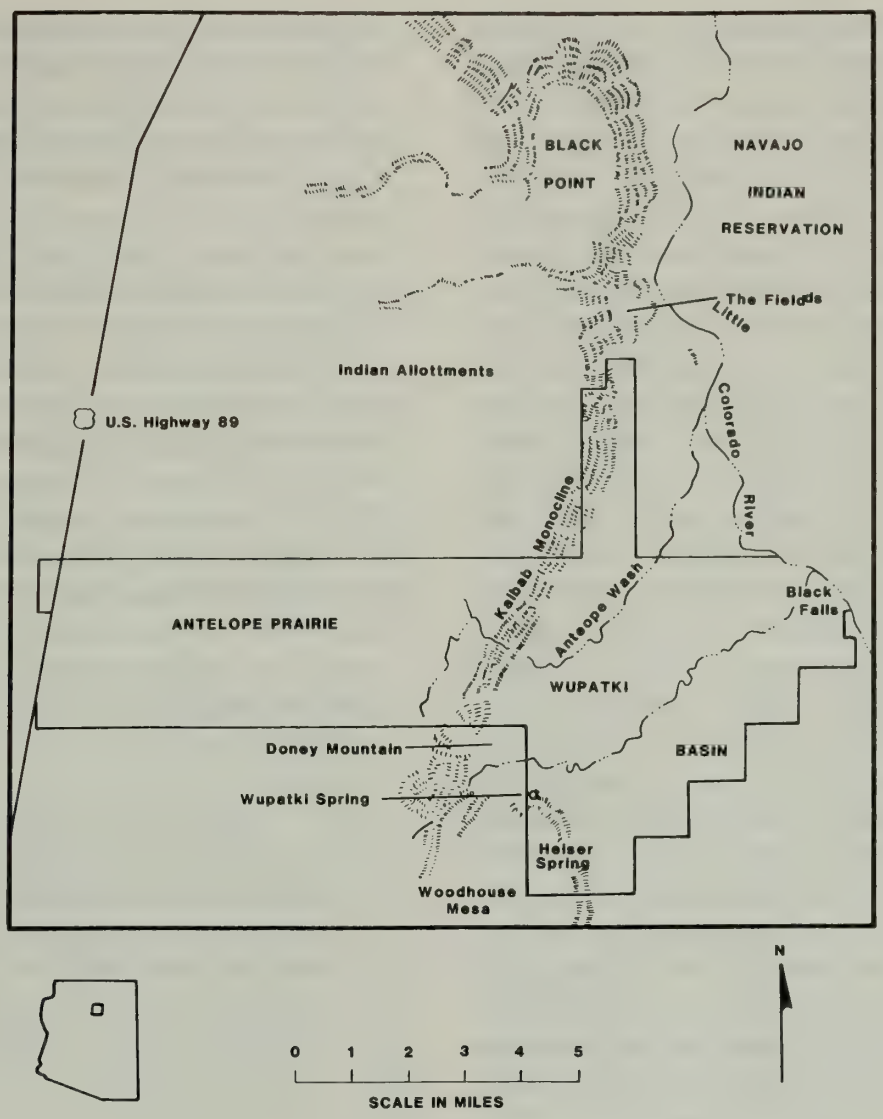


FIGURE 6.2. Major Geographic Features Significant to the Navajo Occupation of Wupatki National Monument.

the first decades of the nineteenth century. Havasupai accounts place the first Navajos to move into the Coconino Plateau region during the 1860s. During the drought years of the early 1860s, according to Ellis (1974:468-478), Navajos were fleeing their homes surrounding the Hopi mesas for the pinon crops in the San Francisco Mountains and the Coconino Plateau and the water offered by the Little Colorado River.

Navajos were also fleeing west during this time to escape the ravages of the U.S. Army. In 1863, by the orders of General James H. Carleton, the Army launched a military campaign against the entire Navajo population. Under the charge of Col. Christopher (Kit) Carson, U.S. troops invaded Navajo country, seeking the surrender of Navajo males. Those who did not surrender were shot, agricultural fields were burned, and livestock was destroyed. By December

1864, 8,354 Navajos had made the Long Walk to the "settlement" camp at Fort Sumner, New Mexico (Young 1978:34).

By 1864, word of the campaign had reached the Coconino country. Peshlakai Etsidi and his parents' families, along with Baa' and her extended family, continued their highly mobile seasonal movement and avoided the U.S. Army. In 1867, however, facing starvation, they surrendered and walked over 500 miles to captivity at Fort Sumner (Brewer 1937; Ellis 1974:461-468).

It was following Peshlakai Etsidi's return from Fort Sumner shortly after 1868 that the Navajo occupation of the Wupatki basin really began, although these lands were far outside the reservation boundaries established by the treaty of 1868. In about 1880 (P. Johnston 1939), Peshlakai Etsidi married both Baa' and her daughter by a previous marriage, and moved to her family's summer home at the base of Black Point, approximately four miles downstream from Wupatki (Figure 6.2). Having lost all possessions during their incarceration, Peshlakai Etsidi and his wives began to rebuild their decimated livestock populations. In the next twenty years they built a family, and eventually, a large holding of agricultural fields and livestock. By 1908, Peshlakai Estsidi and Baa' had 10 acres under cultivation (B. Johnston 1940) and his family had become one of the most prominent in the Little Colorado River area. By about the age of fifty, Peshlakai Etsidi had become a medicine man of the Wind Way Ceremony and had attained nataani or headman status (B. Johnston 1972:172-173; Peshlakai 1961:8-9).

During the decades between Peshlakai Etsidi's return from Fort Sumner and his settlement at Black Point, however, other external processes were in effect that would once again strip his and other families of their livelihoods. Beginning in the 1870s, Anglos were again pushing their way into the Little Colorado River valley. The first permanent Anglo settlements along the Little Colorado River were those of the Mormons, who colonized southward from Utah in 1875 and 1876. After crossing the Colorado River at Lee's Ferry, the Mormon wagon trains traveled southeast across badlands to Moenkopi, then turned 25 miles west to the Little Colorado River. From the intersection of the wagon road with the river, there were three resting places before reaching the first settlement 100 miles to the south. The first was four miles upriver, at a cottonwood-sheltered stop known as Camp Utah, and the second was 25 miles further south at Black Falls, on the eastern border of what is today Wupatki. At Black Falls, the river spread over a lava outcrop, forming a waterfall 125 feet wide with a 13-foot drop:

> Unlike most of the country along the lower river course, the rolling hills around Black Falls provided fairly good grazing. From the first, herdsmen who marveled at the Indian ruins that have since been dignified as Wupatki National Monument, held stock there that were too weak to make it on to the settlements (Peterson 1973:84).

Undoubtedly, the Wupatki Navajos had some contact with the Mormons at Black Falls, although Navajo settlement had not yet pushed into the Wupatki basin during the 1870s. In addition, the Mormons destined for Sunset and Brigham City about 60 miles south, stopped only temporarily at Black Falls. While Mormons and Navajos may not have been in direct contact in the Wupatki basin, the Mormon presence in Little Colorado country had indirect effects on the Wupatki Navajos.

Following the establishment of Sunset, Mormon pioneer Lot Smith eventually acquired large herds of cattle and horses, graz-

ing them under the "Circle S" brand from the San Fransisco peaks to the Colorado River around Moenkopi and Tuba City, including the Wupatki basin (Hartman and Wolf 1977:22-23). Moenkopi had become the center of Mormon pioneer missionary work among the Hopis beginning in 1873, and a small Mormon missionary community was formed at Tuba City, named for a Hopi who had befriended the settlers. By the 1890s, however, the mission program was obviously failing and conflicts over water were increasing between Mormons and both Navajos and Hopis (Peterson 1973:196-200). Mormons attempted to gain legal claim to grazing lands and water sources; in 1892, Lot Smith was killed by a Navajo near Moenkopi over grazing rights.

Indian Affairs administrators supported the growing Indian opposition to the Mormon presence, and, by 1902, Mormon settlers were expelled from Tuba City. During the final years of Mormon settlement in the Tuba City/Moenkopi area, the Western Navajo Agency had been created by the federal government between the 1882 "Moqui" reservation and the Colorado River. Following the expulsion of Mormon settlers, Tuba City was designated as the Western Agency headquarters in 1903. Government installations including schools, medical facilities, and government agents followed, making Tuba City an administrative center for the local Navajo population (Bailey and Bailey 1986:107).

The Mormons were not the only people seeking the Navajos' salvation in the Little Colorado River valley in the final years of the nineteenth century. In 1896, Reverend William R. Johnston of the Young Men's Christian Association brought his wife and son, Philip, from Kansas to Tuba City to establish a Methodist mission. Four years later, Johnston moved the mission upstream to Tolchaco, approximately 20 miles south of Wupatki. The mission remained until 1918, during which time Johnston witnessed the Navajos' systematic loss of traditional grazing lands to private interests (P. Johnston 1936). Johnston aided immeasurably in the retention of some Indian lands and additions to the western and southern boundaries of the Reservation.

Johnston's arrival in Arizona was preceded only 14 years by the arrival of the Atlantic and Pacific Railroad. The railroad arrived in Flagstaff in 1882, initiating decades of land conflicts for the indigenous population. The congressional bill to create the Atlantic and Pacific Railroad was signed in July 1866 by President Andrew Johnson, and the railroad was created, along with a land grant of all odd-numbered sections for 40 miles on either side of the tracks in the territories. In the Arizona and New Mexico territories, the grant included an additional 10-miles indemnity strip, for a total of 50 miles on either side of the track (Bryant 1974:94). The indemnity strip was revoked in 1887 and returned to the public domain (Greever 1954:37); nonetheless, the land which Peshlakai Etsidi had settled at Black Point, unbeknownst to him, became railroad property.

Concomitant with the arrival of the railroad was the arrival of large-scale cattle ranchers, who could take advantage of the large tracts of railroad and public-domain lands surrounding Navajo country. The railroad could sell its alternate sections, or barring the ability to sell them, could make exchanges "in lieu" with the federal government for public-domain land elsewhere. The former railroad lands then reverted to the public domain, and the new lands which the railroad received in exchange could also be sold. Through this process, between 1883 and 1904, disposition of railroad lands resulted in the sale of millions of acres to private interests. In 1884, for example, the

Aztec Land and Cattle Company purchased a million acres at 50 cents per acre (Bryant 1974:94). Within the next few years, these sales proved disastrous to Navajos throughout Navajo country, and those in the Wupatki area were no exception.

Ranching operations, large and small, claimed the prairie grasslands in the Flagstaff region, concentrating on control of scarce water sources (Trimble 1982:22). Within a few short years after the arrival of the railroad, the Aztec Land and Cattle Company, the Arizona Cattle Company, Lot Smith, the Babbitt Brothers' CO Bar Ranch, the Kellam Land and Cattle Company, (Trimble 1982; Babbitt 1967), and numerous small ranchers such as Mr. and Mrs. Charles Heiser and Rimmy Jim (Preston Mercer, personal communication 1984) claimed, divided, bought, sold, and controlled the land upon which Navajos were well established.

Documented conflicts between Navajo families and Anglo cattlemen began in the winter of 1896-1897. The board of supervisors of Coconino County, members of which were local ranchers, ordered a 20-man posse to "assess the property" of Navajos in the county. Demanding an immediate five-dollar tax per 100 head of sheep from the Navajos, and knowing that they would be unable to pay, the posse drove sixteen families, including that of Peshlakai Etsidi, from Coconino Point across the Little Colorado River:

> Snow was falling (a deep snow already covered the ground), the weather was bitter cold, and the ewes were lambing. The Indians pleaded for a reasonable time within which to remove, but were denied. Their houses and corrals were burned and they and their flocks were rounded up and pushed toward the Little Colorado River with a relentless haste, the posse keeping women, children and animals in a fright by an intermittent fire from rifles and revolvers. When the river was reached it was found to be so deep as to require the sheep to swim. The posse surrounded the flocks and pushed them into the water, and nearly all the lambs, with many grown sheep, went down the stream or chilled to death after crossing, and many died afterward from the effects of exposure. The loss to the Indians was equivalent to several thousand dollars (U.S. Commissioner of Indian Affairs, 1897).

The sheriff had already been informed that it was the Indian Office's intention to permit Navajos to continue using public-domain lands for livestock grazing. Following the incident, the acting Navajo Indian Agent recommended that suit be instituted for damages and the Navajo families be allowed to return to their traditional winter pasture. Reports were sent to the attorney general and the governor of Arizona requesting action against the responsible parties and restitution to the Navajos (U.S. Commissioner of Indian Affairs 1897). Regardless of these retaliatory actions, however, the expulsion was only the first of many to be instigated by the cattlemen, who had come to stay.

Within the next two years, battles again erupted over rangeland and water sources south of Wupatki in the Canyon Diablo area. In 1898, competition between Navajo sheep owners and Anglo cattle owners over the use of a spring led to the death of the young daughter of Biwoo' Adin, a medicine man from the Grand Falls area (Peshlakai 1961). The medicine man was then "set up" by the ranchers on a trumped-up horse-theft charge, arrested, and sent to jail. The false nature of the charges were exposed by D.M. Riordan, Flagstaff lumberyard owner and former Navajo Indian Agent. Biwoo' Adin was released, but seeking revenge, the ranchers again brought charges against the Navajos. This time, while Biwoo' Adin and his sons were hunting, the ranchers filed an "assault with a deadly weapon" charge with

the sheriff and were given arrest warrants to bring the Navajos in. Armed with arrest warrants and guns, the ranchers rode to the hunters' camp and opened fire. Two Navajos and one Anglo were killed, and Biwoo' Adin and his son were arrested for murder. With the help of the missionary Johnston, a U.S. district attorney was assigned to the Navajos' defense and the charges against them were dropped (P. Johnston 1936, 1942; B. Johnston 1972).

Johnston did not stop at the local level in his attempts to secure Navajo traditional use areas. In 1902 and 1904, accompanied variously by Peshlakai Etsidi and headmen Chishi Nez and Biwoo' Adin, Johnston went to Washington to seek aid from the highest levels. On the second trip, Johnston, Peshlakai Etsidi, and Biwoo' Adin, with young Philip Johnston acting as interpreter, met with President Theodore Roosevelt. Roosevelt presented the Navajos with medals, proclaiming them "official" headmen of the tribe, and promised federal help (W. Johnston 1904; P. Johnston 1939; Peshlakai 1961).

Help came in 1908 with the arrival of a special allotting agent from the Office of Indian Affairs. The agent withdrew several townships from further settlement until such time as proper allotments could be made to all the individuals concerned, in addition to proceeding with several actual allottments. Not among the withdrawls or allottments, however, was T26N R10E Section 9, containing Peshlakai Etsidi's fields and the summer hogans of seven related families at Black Point. This section remained under the owenership of the railroad company, which refused to negotiate with the federal government for the release of the section (Collier 1940).

In January of the following year, Peshlakai Etsidi applied for T26N R10E, SE 1/4 Section 4 on the Little Colorado River, so that some arable floodplain land could be retained, and for T26N R10E, SE 1/4 Section 24 on the public domain of Antelope Prairie, where his sons had constructed a rain-catchment reservoir. The allotments were approved, with the Section 4 land in Peshlakai Etsidi's name and the Section 24 land in the name of a minor child. After 1910, Peshlakai Etsidi's family constructed hogans near the reservoir on Section 24 and continued to use it, along with the agricultural fields in Section 4. In 1923, as the Section 4 land had been destroyed by floods, the Section 24 allotment was transferred from the child's to Peshlakai Etsidi's name, and he was issued a trust patent for the allotment (Collier 1940).

The fact that Peshlakai Etsidi and related families had gained legal title to six allotted 1/4 sections in T26N R9E, however, did not hinder Anglo cattle ranchers from evicting the Navajos from their own lands. The six allotted 1/4 sections, totaling only 960 acres, were surrounded by the domain of cattle ranchers. The reservoir that Peshlakai Etsidi's sons had constructed proved too much temptation for the ranchers, and once again, Navajos became trespassers on their own lands. Between about 1919 and 1929, the assaults upon Navajos were frequent and severe. During the decade, the Navajo's homes were destroyed, their belongings, including their allotment papers and Peshlakai Etsidi's meal from Roosevelt, were stolen, livestock thefts were forged, and individuals were imprisoned. In 1926, Section 9, the original agricultural settlement at Black Point, was sold by the railroad to private Anglo cattlemen. The final assault came in about 1929, after which the Navajo families left the fields and prairie allotments permanently (P. Johnston 1935, 1939; B. Johnston 1940; Peshlakai 1961; D.N.A. n.d; Phoenix Gazette, March 28, 1980). Navajo access to these lands was not

again secured until 1985 (James Babbitt, personal communication 1987).

During these tumultuous years, another influence slipped unnoticed into the Navajos' remaining domain. Wupatki National Monument was established by presidential proclamation in 1924, including only 2,234 acres surrounding Wupatki and Citadel/Lomaki ruins (Hartman and Wolf 1977). The Monument was created through the efforts of Dr. Harold S. Colton, founder of the Museum of Northern Arizona (MNA), to protect the large ruins from the ravages of increasing vandalism and pothunting. For nearly ten years, the existence of the Monument had little impact on the Navajo population residing in the Wupatki Basin.

In 1933, however, the Museum of Northern Arizona (MNA), together with the Civil Works Administration (CWA), began excavations of Wupatki ruin. Two field camps were established, and the Wupatki spring was improved with a pipeline system providing water to a large tank. In the summer of 1934, the first National Park Service seasonal "custodians" were assigned to the new Monument. The arrival of Jim Brewer and his wife Sallie Brewer marked a turning point in the history of relations between Navajos and Anglos at Wupatki.

The Brewers' introduction to their custodianship at Wupatki included one-room quarters within the pueblo ruins, forty miles of dirt roads to the nearest community, and a local population of about forty Navajos (Sallie Brewer Harris, personal communication 1984; Smith n.d.: 79.1-79.4; Schroeder 1957). Their residence was divided between a restored room in the ruin and the CWA cook shack, in which the cast-iron stove still functioned. Water came from a pipe extending from the spring and was transported to the ruin and cook shack by hand. There was a quarter's allowance of $25 for the purchase of such items as a Coleman stove, and, during the months that NPS could provide no appropriations at all, the Brewers were retained on a monthly salary of $60 by MNA. On this small stipend, they protected and interpreted the area, collected mammal specimens for the museum, and excavated exposed burials in the pueblo. Sallie's 1932 Chevrolet roadster provided the only transportation until the transfer from Canyon de Chelly of a Bureau of Roads truck valued at $5.00 (Schroeder 1957, Sallie Brewer Harris, personal communication). With no amenities other than the facilities provided by the MNA/CWA excavation camps, Jim and Sallie quickly established a close rapport with their Navajo neighbors.

Four extended family groups, all related to Peshlakai Etsidi, were residing in the wupatki Basin during this time, moving seasonally among established residences. Peshlakai Etsidi and his wife, both in their eighties, were living year-round in the basin with numerous children and grandchildren. Taking a sympathetic interest in the young strangers that had been "abandoned" in the desert, Peshlakai Etsidi and Baa' welcomed their new "grandchildren" and quickly gained the permanent names of Grandfather and Grandmother Peshlakai.

Among the other families was that of Clyde and Sarah Peshlakai, son and daughter-in-law of Peshlakai Etsidi and Baa'. Having had some formal education and employment away from Wupatki, Clyde spoke some English and became Jim and Sallie's interpreter as well as the overseer of their activities. Clyde advised and assisted with various park duties, while Sarah assisted Sallie in learning to weave on a Navajo loom. The Brewers, in turn, provided staples to the Navajo families when necessary, took Clyde and others on trading trips to Hopi or Flagstaff, and provided help as

FIGURE 6.3. "Grandmother" and "Grandfather" Peshlakai in 1935. Photo by Jim or Sallie Brewer, courtesy of the Museum of Northern Arizona (MS242-2-38).

required. Primarily, however, the custodians and the Navajo residents provided each other with company and friendship in the isolated desert basin.

If NPS provisions to Monument custodians were meager during the Depression years of the 1930s, they were not alone in their poverty. A combination of national and local factors had combined during the 1930s to put severe stress on the Navajo population across the Reservation, and the far western boundary was no exception. Extreme erosion on the Reservation had prompted the Indian Service to implement the Federal Stock Reduction Program, in which the Navajo livestock population was to be reduced from 1,300,000 "sheep units" to 400,000 (Bailey and Bailey 1986:186). Having a limited market for wool or mutton due to the depressed national economy, many of the Navajo livestock were simply destroyed, leaving almost no Navajo individual unaffected, either economically or psychologically. In the Wupatki area, these factors, in addition to the previous loss of agricultural and grazing lands, combined to create a state of economic hardship among the Navajos. It was during these years also that tuberculosis was rampant, causing even further loss of possessions to medicine men to perform curing ceremonies. The Brewers witnessed this loss of possessions, followed by the loss of family members and the abandonment of the hogans in which the patients died, throughout their first winter in Wupatki (J. Brewer, SMMNR 1934; S. Brewer n.d.).

When Philip Johnston returned to Wupatki in 1934 after a long absence, he found his Navajo friends in poverty. Rather than residing at the fertile agricultural fields along the base of Black Point that Johnston remembered from his childhood, Peshlakai Etsidi and his family were living in the barren stretches of the Wupatki basin, with meager fields and small numbers of livestock (P. Johnston 1939). Johnston, together with his wife, Bernice, and Dr. Harold S. Colton of the Museum of Northern Arizona, began attempts to secure the Wupatki Navajos' traditional grazing lands. Together, the Coltons and Johnstons located allotment files, searched out maps and correspondence, visited abandoned homesites with former Navajo occupants, corresponded with commissioner of Indian Affairs John Collier, and made every possible effort to determine the status of Navajo lands around the Wupatki basin. The process continued for six years, during which time Indian Service officials acknowledged that Peshlakai Etsidi's agricultural lands at Black Point had been sold in error and would be replaced to him by the federal government. The promises remained unfulfilled (P. Johnston 1939; B. Johnston 1940).

It was during the process of these efforts, however, that a more positive event was engraved upon Wupatki history. Ideas of a Wupatki Christmas Party were generated during the Johnstons' visit, and in December 1935, the idea came to life. Philip and Bernice Johnston returned from California, accompanied by the Brewers and Dr. Watson Smith, archeologist on the early excavations of Wupatki pueblo, and the Christmas Party of 1935 was initiated. This unparalleled event has been fully detailed by Dr. Smith, who recalled that it " was a kind of amalgam of the Christian observance and a Navajo 'sing' of indeterminate character but directed in general, as all such Navajo ceremonies are, toward the search for Beauty and Peace and the readjustment of man's harmony with the Universe" (1985:331).

The Johnstons brought boxes of clothing donated from friends in Los Angeles; Sallie Brewer bought cooking utensils, shopping bags, hand lotion, toys, tobacco, and cigars; Watson Smith arrived with 20 loaves of fresh bread and packages of oranges, candy, and nuts. With money donated by the Coltons, Smith also procured metal bread boxes for the hogans, tree decorations, and toys from Babbitt's and Woolworth's department stores in Flagstaff.

Jim Brewer had begun preparations early, borrowing a camp outfit from the Forest Service to accommodate at least 30 guests for three meals each. The road leading in from Sunset Crater was cleared and at the request of Peshlakai Etsidi, a special fir tree from the high mountains was selected and cut for the Christmas tree. The tree was brought to Wupatki by Jim and Clyde on the Friday night before the party, where it was anchored to a stand and placed in front of the CWA cook shack. The next morning Sallie trimmed the tree with the decorations from Flagstaff and placed the gifts under it. By noon, the Navajo families began to arrive, wagon by wagon, full of parents and children dressed in their best velveteen and turquoise, with sheepskins, blankets, and presents.

As evening approached, huge pots of beans, mutton, bread, coffee, and prunes were set to simmer in the cook shack, while a bonfire was lit outside. Blankets and pads were set on the ground for the guests and hosts to share the Christmas feast. With night descended and dinner finished, the dishes cleared and the final presents wrapped, the headlights of three cars were turned on the tree. Clyde Peshlakai, Philip Johnston, and Sallie Brewer distributed the

amassed gifts to the Navajos, and in turn, gifts of rugs and jewelry were distributed to the Anglos.

Gift exchanging completed, the neighbors stood together around the fire and Philip Johnston spoke in Navajo and English, ". . . welcoming everyone . . . and philosophizing a bit upon the respective meanings and virtues of the Anglo and the Navajo Ways, and the power for good that was implicit in their harmonious mingling on this happy occasion..." (Smith 1985:333). Then the party moved to the cook shack for balloons, popcorn, and more conversation (Smith n.d.:80) until bed.

Following a large breakfast in the morning and before the families split up to attend to their livestock and homes, Peshlakai Etsidi addressed the group, explaining that the tree was now to be consecrated as ceremonial paraphernalia and treated accordingly. Two boys were assigned the task of burying the tree in a rocky shelter, safe from the desecration of animals or other agents. The party then split up, Johnston taking several people along with an agency superintendent from Tuba City to look at allotments, others leaving for home and talking about next year's party (Smith n.d.:81).

The momentum of goodwill generated by the Christmas Party did not subside during the following year. By spring of 1936, discussions began between the Navajo residents and the Brewers for a second large event. While relations between the Navajos and the NPS employees could not have been improved after the Christmas Party, the next event would prove to have even greater historical impact.

The Brewers, who had been considering various means of preserving the local traditional Navajo arts for some time, took the opportunity to discuss the matter with the Navajo residents on the evening of February 7, 1936 (Brewer 1936 in Smith n.d.81-89). While most of the Wupatki Navajo population was gathered at a nearby hogan on a

FIGURE 6.4. Setting up the tree at the 1935 Christmas Party. Photo by Sallie Brewer, courtesy of the Museum of Northern Arizona (MS242-2-43).

ceremonial occasion, the Brewers arrived with the suggestion of an exhibition of the finest Navajo arts from the area. Interpreting for the crowd, Clyde explained the plan for a "Na'nizhoozhi yazhi," a "little Gallup Ceremonial." The plan was met with enthusiasm, especially by Peshlakai Etsidi, who suggested a revival of old-time arts, such as saddle-making and the use of vegetal dyes in weaving. The following June 6 and 7 were selected as the dates for the first annual Navajo Craftsman Exhibition, and plans were underway.

By spring, preparations were in full swing. Word of the exhibition spread rapidly among the Navajos, with its emphasis on high-quality craftsmanship rather than

> . . . the more usual "come-and-see-the-strange- Indian-and-his-odd-rugs" type of affair, to which the Indian is brought by the promise of payment, food, gambling, etc. We want to play on their interest and pride of workmanship, and offer them examples of good work, half-forgotten crafts, etc., and a probable market for their products . . . (Brewer 1936 in Smith n.d.:82).

In a joint effort spanning four months, the NPS custodians prepared. A site was selected near the Monument in a small basin out of sight of the ruin, and juniper and pine posts began to be collected, stripped, and hauled to the site for curing. The Coltons brought examples of old-style weaving from the Museum for display and as models for the exhibitors, a medicine man promised old items in his possession, Richard Van Valkenburgh loaned an old-style dress. Through the spring, artists and craftsmen worked on leather work, silver jewelry and bridles, and rugs and blankets, and children brought in carvings and drawings. The Forest Service, the MNA, and the Coconino Highway Department provided assistance in procuring and hauling logs. Babbitt's provided tags for the exhibits, and Sallie's father sent Mexican pesos for silverwork (J. Brewer 1936). By early May, the great hogan was ready for construction.

Construction of the frame for the "ceremonial" forked-stick hogan began on May 4, and required 14 men, not including log hauling (J. Brewer 1936). By the end of the month, the structure was complete. It included 140-150 tree trunks, 202.5 cubic feet of dirt, 455 gallons of water, and 457 man-hours of labor. The result was a "5 1/2 axe" hogan (measured in axe handles), making it comparable to the hogans built for the Night Dance or the Mountain Chant. The structure measured 14 feet in height and 18 feet in diameter, and was said to be "the best hogan between Cameron and Leupp" (Brewer 1936 in Smith n.d.:82.1-82.2).

After four brush ramadas and outhouses were added to the site, notices were mailed to the Tourist News and the Coconino Sun, and invitations sent to the custodians at Walnut Canyon, Petrified Forest, and elsewhere (Brewer 1936), the show opened on June 6, 1936. On hand for the opening were Dr. and Mrs. Colton, Miss Katherine Bartlett, Mr. Charles Steen, and--during the course of the two-day event--127 other visitors. One hundred and ten exhibits were displayed by 31 exhibitors.

As described by Brewer in the Monthly Narrative Report for May 1936, opening day revealed the hogan furnished with traditional items including a metate and mano, sheepskins, cooking pots, blankets, ceremonial and secular outfits, arrow quivers, a silver bridle and concho belt. Seated in the hogan were older men wearing traditional split-seam cotton pants, moccasins, silver jewelry, and long hair. In the four ramadas were the exhibits to be judged, in addition to displays of silverworkers and weavers at work. Rugs hung from the vigas

and the sides of the ramadas, and jewelry, leatherwork, and other items occupied display cases from the museum. Outside, another man demonstrated the use of a traditional sweathouse, as Dr. Colton filmed the event in color.

Mrs. Colton and Peshlakai Etsidi judged the exhibits and awarded the prize money. Judging was followed by a "pow-wow" of 41 people in the hogan for the purpose of explaining the judging and encouraging better weaving with the use of pictures from Mrs. Colton's Navajo Arts scrapbook. "Pow-wows" continued in the hogan the second day, with speeches made by Peshlakai Etsidi and Clyde Peshlakai on the value of better weaving and silverwork. By the end of the second day, 39 of the 110 exhibits had sold and 21 of the 31 exhibitors had won prize money totaling $250. On July 7, 1936, the first annual Navajo Craftsman Exhibition was over but by no means forgotten. The event is still repeated yearly at the Museum of Northern Arizona as The Navajo Show in the Festival of Native American Arts, continuing a tradition over 50 years old.

At the close of 1936, a second Christmas Party was held that rivaled that of the previous year. The party ushered out a golden year in Wupatki's history and in the relations between Anglos and Navajos in the Wupatki Basin. The next year brought the beginnings of change to the Wupatki Navajos, although it would not be felt for many years to come.

In the summer of 1937, the Brewers were replaced by Wupatki's second custodian, David Jones, and shortly thereafter, his new wife Courtney. The Joneses shared the enthusiasm and compassion of the Brewers, and interactions between them and the Navajos remained positive and strong. Clyde Peshlakai became an integral part of the NPS operations at the Monument. For the first couple of years of their custodianship, the Joneses spent the winter seasons at Casa Grande National Monument in southern Arizona. During these absences, Clyde took over as caretaker and guide. Entries to the Monthly Narrative Reports (May 1938) following the Joneses' return in the spring attest to the fine condition of the monument under Clyde's care, and the creativity involved in his assumed responsibility of sign painting. Evidence of his creativity in guided tours of the monument also comes from a story related to Watson Smith by Carlton Wilder, ranger-naturalist at the Grand Canyon, of an incident that occurred during a late summer visit in 1938 (Smith n.d.:82.11-82.12).

During his guided tour of the monument, Wilder noticed a spherical object on the floor of one of the excavated rooms that resembled the color widely known as "Park Service Green." Upon Wilder's asking Clyde as to the origin of the object, Wilder was informed that it was a fossil watermelon. The story became a regular feature of all of Clyde's tours, apparently illiciting a variety of responses from visitors. As related by Smith:

> Persons who had approached Wupatki over the road from Tuba City and Cameron would already have undergone a mild degree of brain-washing by their exposure to the "petrified pumpkins" scattered about on the bare wind-scoured sandstone ledges there. After that, a fossil watermelon would not have been too hard to take, especially in the moon-scape world where nothing was wholly credible anyway.
>
> There may have been other travellers whose receptivities had been conditioned by other factors, especially by their earlier preconceptions of the Native American. To some he might perhaps be the Noble Savage, in tune with the mysteries of Life and possessed of a vision denied to the less prescient Anglo visitor, who was too spiritually myopic to see into the reality

of watermelons. Or, to other, "The Indian" may have seemed just a dumb cluck, himself deluded by the patently absurd . . .

In either case . . . the circumstantial evidence pointing to Clyde's creative genius is persuasive: first, Clyde was there; second, he had access to the supply of Park Service Green; third, spherical stone objects were not uncommon in the vicinage; fourth, the concept and the presentation were consistent with the low-key, unsmiling, practical jokery of Navajo humor, whose subtle character might well be lost upon the casual traveller (Smith n.d.:82.12-82.13).

In return for Clyde's caretaker and ranger duties, the custodian performed burials, rushed pregnant wives to the hospital in Tuba City, attended to injuries among the Navajo children, and dealt with other contingencies as they arose. The Joneses continued the task of attempting to secure the Navajo rights to their traditional lands. Mrs. Jones tackled weaving with the Navajo women and recorded accounts of the weaving process from shearing to trading the final product, short biographies of the weavers, and documentation of various wools. She worked tirelessly on programs to improve the local sheep herds for meat and high-quality wool. Clyde offered advice and assistance in the construction of the new, official Park Service masonry home for the custodians, and even built a matching one for himself nearby. Navajos brought in unusual geological specimens, fossils, and flora and fauna, many of which are still incorporated in the Wupatki collections.

During these years of mutual respect between the NPS and the Navajo residents of the Wupatki basin, however, other factors were coming into play that would eventually erode their cooperative relationship. In July 1937, Roosevelt's Presidential Proclamation Number 2,243 increased the size of the Monument by 33,631.20 acres,

FIGURE 6.5. Clyde Peshlakai as caretaker of Monument, circa 1935. Photo by Jim or Sallie Brewer, courtesy of the Museum of Northern Arizona (MS 242-unnumbered "a").

encompassing nearly the entire Wupatki basin. The use-areas of the four major family groups who had resided in the basin since before the arrival of the first custodians in 1934 were now NPS property. After the end of World War II, the Navajos would become an "administrative problem."

The first Navajo policy statement was issued late in 1937 by A.E. Demary, Acting Director of the NPS, in response to inquiries from Dr. Harold Colton, who was still engaged in Navajo land investigations with Philip Johnston. Mr. Demary stated that ". . . there is no objection, administratively, to the continued residence for the duration of their lifetime of those families residing within the Monument, so long as their

presence is not inimical to the purpose for which it was established and extended" (NPS n.d.). While the issue came to rest during the war years, the clause "continued residence for the duration of their lifetime of those families residing within the monument," would surface again in 1950 and remain an issue until the present day.

For the time being, however, the policy statement was adequate, and Navajo use of the monument continued more or less as it had for at least a decade. Small changes came after 1939, first with the death of Peshlakai Etsidi. Etsidi died in the spring of 1939, during the Joneses' absence from the monument (Jones in SMMNR 1939), and was buried near the hogan in which he died by two Civilian Conservation Corps enrollees. The era of Navajo fluorescence in the Wupatki Basin ended with Peshlakai Etsidi's passing, as the "War era" and the "National Park Service era" began.

Signs of change began to show after the Monument boundaries were enlarged, concomitant with range analyses indicating that the Wupatki basin was over grazed. The Navajo families were asked to remove their sheep from the Monument during the summer growing season in order to let the grass regenerate, thus modifying their established seasonal grazing patterns. Relations remained strong, however, as Jones noted in his monthly report for March 1940 that "A genuine feeling of friendship exists between the National Park Service and the Navajos of Wupatki Basin, as a result of the policies established in the past to guide our relations."

In any case, by October of the same year, attention from daily matters was diverted as registration for the draft began. By April 1943, several of the young Navajo men and Davey Jones had been called to service. The files of Philip F. VanCleve, Acting Superintendent during Jones' absence, document the impact of the distant war on the Wupatki Navajo population (VanCleve personal communication, 1985). VanCleve served as the lifeline between Navajo parents and their children stationed in unknown foreign places. He wrote extensive correspondence to the young soldiers from their parents and explained the messages that came in return. Later, he helped to settle the estate of at least one of the veterans who died in the war, even returning to Wupatki after his reassignment elsewhere to finalize the settlement. While the Wupatki Navajos' involvement in the war was direct, their indirect involvement was perhaps even more significant.

Forty years after interpreting conversations between President Roosevelt and Peshlakai Etsidi, Philip Johnston used the knowledge of the Navajo language that he gained at Tolchaco Mission to develop the Navajo Code Talkers. The Navajo Code Talkers were formed in 1942 as a special communications arm of the U.S. Marines. Using a code language based on Navajo, the Code Talkers transmitted secret military communications; in fact, ". . . the only system of air-tight, secret communications by voice radio . . ." (Johnston 1944). "Considering [this] remarkable fact," wrote Johnston, "I have every reason to believe that the Navajos will make real history before we are finished." Only eighty years after the incarceration of their grandparents at Fort Sumner by the U.S. Army, the Wupatki and other Navajos made an historical contribution to the American defense in World War II.

With the close of the war, attentions turned again to domestic matters, and at Wupatki, to the administration of the increasingly complex Monument. By the time Jones resumed his superintendency in January 1946, the National Park Service bureaucratic structure had grown as well. After the Joneses left Wupatki at the close

of 1949, the role of Navajos in the Monument came into question. While the intention of Demaray's 1937 directive regarding the use of the Monument by the Navajo families through the durations of their lifetimes was acknowledged, concern with grazing and damage to the Monument's resources was stressed. In a May 1950 memorandum from National Park Service Director Newton Drury to the Regional Director, Demaray's policy is referenced as a preface to further policy statements:

> All grazing should be conducted so as to avoid injury to the range and no material increases should be permitted in the bands of sheep so grazed. The Service should prevent any abuses from the use of the range by the sheep of the Navajos, through insistence upon better management, or reductions if necessary.

> Since the Indians use these lands solely as licensees and without any established vested rights in the lands or watering facilities, it seems clear that the Service is under no obligation to maintain the facilities.

The memo goes on to recommend that the watering facilities be maintained by the NPS, however, so as not to leave the task to the Navajos, since "there is little reason to expect that such limited maintenance as they might perform would be accomplished in a manner satisfactory to this Service."

By the time the Navajo issue surfaced again in 1962, only one of the former four large, extended families remained on the Monument. During the next few years, memos alluding to allegations of pressuring the Navajos to leave the Monument were dispatched, assuring that no such pressuring tactics had been employed by the NPS (e.g., Mangan to Beaver, December 8, 1964; Mahan to Danson, September 21, 1967). Three of the four families were reported to have left the Monument voluntarily between 1951 and 1961 after the heads of the households died and, according to the established policy of 1950, privileges to the use of the Monument by remaining family members ceased. "The mere fact" according to a July 2, 1964 memo, "that waterholes on their reservation allotment have gone dry in no way entitles them to return to Wupatki."

Thus, it is apparent that by the mid 1960s the presence of Navajos within the Monument boundaries had become intolerable to the NPS. Correspondence of the 1960s indicates that the goodwill and respect generated by the custodians of the Monument only thirty years before were outdated concepts. Gone was the recognition that the Navajo occupation of the Wupatki Basin predated that of the NPS by over half a century. The overriding issue regarding the Navajo presence was the legal basis of NPS superiority and rightful ownership of Wupatki rather than an ethical and moral recognition of the traditional Navajo use-areas that were set aside, unbeknownst to the Navajo residents, as a National Monument. The correspondence speaks for itself:

> Our question is can we tell them where they can live and what they can build or do we allow them the run of the Wupatki Basin to do as they have always done, move when and where they want and construct what they want (Mahan to Regional Director, January 14, 1965).

> We have had Indian residents and their herds by sufferance for many years. The advanced age of Clyde Peshlakai, the last of the Navajo residents in the Monument, gives hope to an early end of this non-conforming use (Beard to Mahan January 21, 1965).

> At no time have the Navajos who grazed within the monument had any title in the land. . . . Since the elder Peshlakai has no title in the land he has grazed these many years, he could

> not legally give the land to his children. In the absence of appropriate legislation, these lands could not be surrendered to the Peshlakai family. We believe such legislation would not be in the public interest (Acting Director Hammel to Senator Fannin, June 1970).

> We understand your desire to negotiate permits or other agreements concerning use, occupancy, and dwelling at Wupatki. However, it is our view that there are no validly existing rights in any Indians to the lands within Wupatki. Therefore, we see no basis for negotiation (Acting Director Hammel to Martha Blue, Attorney at Law, September 9, 1970).

Paper battles continued into the 1970s, involving current and former Navajo residents of the Monument, NPS officials, attorneys representing Navajo interests, officials of the Navajo Nation, the Bureau of Indian Affairs, U.S. senators, and private cattle ranchers. Issues ranged from the return of NPS lands to the families of the original Navajo land users, to protestations over a proposed Wilderness Area status for the Wupatki basin which would eliminate grazing, to a lawsuit filed by the U.S. District Attorney's office on behalf of local Navajo families against the C.O. Bar Livestock Company for compensation of loss of Indian allotments on the Antelope Prarie (cf., Arizona Daily Sun, December 15, 1970; Arizona Republic, December 16, 1970; The Phoenix Gazette, March 28, 1980).

Clyde Peshlakai, last remaining Navajo "head of household" within the Monument boundaries, died on December 4, 1970. NPS was faced with the decision to terminate Navajo use of the Monument according to policy or to renegotiate its position regarding Navajo occupation. Based on determinations of September and October 1970 that the master plan for Wupatki's development included the presence of Navajos as part of the "historical scene," recommendations were made to issue a non-fee, special use permit to a single permittee who would be allowed to graze sheep in the Monument as a "living history exhibit" (cf., Trextler to Southwest Regional Director, September 21, 1970; Cook to Southwest Regional Director, September 25, 1970; Kowski to National Park Service Director, October 5, 1970). Following Clyde Peshlakai's death, the "living history exhibit" theme was expanded:

> One family should be allowed to live on the monument and graze a small herd of sheep. They will be restricted to using a hogan or some traditional, more modest type of dwelling. Their use of the monument lands will be spelled out in a special use permit issued to one person in five year intervals and subject to revocation in the event such use becomes inconsistent with the management policies of the National Park Service. . . . The Navajo family would live near Heiser Spring which is the only water available to water livestock. Monument visitors would be able to see Navajos herding sheep and see the kind of dwellings they use (Wupatki National Monument grazing files n.d.).

Fortunately, such extreme requirements were never implemented. In February 1971, however, the NPS met with officials the Navajo Nation and the Bureau of Indian Affairs and proposed the issuance of a special-use permit to a single individual of the tribe's choice for continued grazing at Wupatki, based on specific range analyses. The proposal was accepted, and a new, official Policy Statement on Navajo Use of Wupatki National Monument was established by the NPS (Wupatki Navajo Grazing Files, February 5, 1971). The policy concluded by stating:

> With the death of Clyde Peshlakai . . . the period of informal grazing at Wupatki National Monument is part of the historical use of the area

> and because it is the desire of the Secretary of the Interior that the National Park Service assist all American people to better understand our cultural heritage and to assist American Indians in their endeavors, it shall be the policy of the National Park Service to allow limited, controlled grazing and residence within Wupatki National Monument by Navajo Indians.

The inclusion of "limited, controlled grazing" in the policy statement referred to the issuance of a special use permit, which would be based on several points. Essentially, the permit would give grazing privileges to a single "head of household," and would be terminated upon the individual's death or decision to abandon grazing privileges. The permit would not be transferable to any other family members. The area of permissible grazing would be specified by the NPS, as would the number of animal units to be grazed, depending upon range analyses which would be revised annually. No fee would be charged for the permit, but the permittee would be bound to NPS regulations while using the Monument, and permission for any developments would have to be obtained from the Monument superintendent. Further, the permit could be terminated if the NPS determined that continued grazing was having an adverse impact on the Monument's resources or if the permittee violated any of the permit's stipulations.

Drafts of the proposed permit circulated among various offices for the remainder of the decade, until a final version was eventually accepted and signed on September 12, 1980. The permittees are the daughters of Clyde Peshlakai, who had remained on the Monument since their father's death. Included in their household are Clyde's granddaughter, her husband, and their three young sons. The extended family occupies a homesite that has been in use by earlier generations of their family since the 1930s. Their emotional, psychological, and physical ties to Wupatki are strong. The young sons, great-great grandsons of Peshlakai Etsidi, represent the fifth generation of Wupatki Navajos since the initial Navajo settlement of the Wupatki basin over a century ago. When the current "permittees" pass on, the future of the last Wupatki Navajos will once again be at issue, and it will be the decision of the National Park Service as to whether Wupatki's Navajo history continues or comes to an end.

Changes in Navajo Land Use

When Superintendent Mahan wrote to the Southwest Regional Director in 1965 to inquire ". . . do we allow [the Navajos] . . . to do as they have always done, move when and where they want . . . ," he was correct in the assertion that Navajos have always "moved." What Mahan apparently failed to understand, however, is that the Wupatki Navajos were traditionally sheep herders and herding depends on seasonal movement among various water and forage resources, and , concomitantly, residences.

The occurrence of Navajo residential mobility has been noted by observers in Navajo country since the late nineteenth century. Mindeleff (1898:484), for example, noted that:

> "Each family moves back and forth within a certain circumscribed area, and the smallness of this area is one of the most remarkable things in Navajo life . . . usually each family has at least two locations--not definite places, but regions--and they move from one to the other as the necessity arises. In such cases they take everything with them."

Hoover (1931:432) recorded the same phenomenon, stating that "For the Navajo, no matter how far he may wander, returns again and again to the same spot or general vicinity." In the Chuska Mountain region, Toulouse (1975:481) noted that the local people "have very definite locations to which extended family units return year after year." And according to Jett (1978:65), "Maintenance of at least one and usually two or more seasonally occupied homesteads or 'camps' with substantial dwellings that are reused year after year has long characterized Navajo settlement."

These statements suggest two generalizations concerning Navajo mobility: (1) that residential mobility is organized in a non-random manner, and (2) that there has been a change over time from large-scale movement between general locations to consistent reuse of specific homesites on a smaller scale. The change in mobility from the use of large areas to the use of specific locations within circumscribed areas has occurred throughout Navajo land as a result of population increase within a limited land base, concomitant with a change from a subsistence economy to a market economy (see Kelley 1986 for a detailed discussion).

Various Navajo land-management projects undertaken since the 1930s in an effort to control overgrazing, establish land management and administrative districts, and regulate livestock production have resulted in a number of studies of Navajo land use (cf., Hoover 1931; Fryer 1942; Kimball and Provinse 1942; Jett 1978). The conclusions derived from these studies regarding Navajo seasonal mobility are, for the most part, "cross-reservation" generalizations based on geographic, climatic, and economic indicators.

Two primary modes of seasonal movement have been documented throughout the Reservation. Jett (1978) terms these patterns the "Lowland/Summer Farm-Highland/Winter Firewood Pattern" and the "Lowland/Winter Pasture-Highland/Summer Pasture Pattern." As implied by Jett's terms, the lowland/summer farm highland/winter firewood pattern of mobility is one in which summer residences are located in lower elevation areas of arable land where relatively stationary agricultural fields are maintained, while residences are moved in the winter to intermediate elevations in the vicinity of abundant sources of firewood. Conversely, the lowland/winter pasture highland/summer pasture pattern is common in those parts of the Reservation where prime summer pastures are located at high elevations.

Hoover (1931) noted the summer-lowland/winter-highland pattern in areas that allow for agricultural activities along lowland water courses, as well as grazing on summer grasses while winter forage is replenishing in the intermediate elevations. In addition to pasturage, intermediate elevation mesas provide protection to animals and humans in sheltered locales; water from seeps, springs, and snow; and, importantly, firewood. The reverse pattern, winter-lowland/summer-highland, occurs primarily in the eastern highland portions of the Reservation where high elevations and surrounding lowlands are found. Moves between summer and winter residences in these areas range from twelve to fifty miles, and are initiated by the availability of winter and summer pasturage. The high elevations provide lush summer grasses before heavy snowfall requires movement to the warmer, dryer surrounding lowlands.

Hoover (1931), Fryer (1942), and Jett (1978) elaborate on the summer-lowland/winter-highland, winter-lowland/summer-highland "model" by correlating the broad patterns of mobility with equally broad economic indicators.

Fryer (1942), for example, suggests that the summer-lowland/winter-highland pattern predominates in steppe environments of 6,500 to 7,500 feet, where there is a dual dependence upon agriculture and livestock. Jett (1978) also notes the occurrence of this pattern in areas where farming is more important than grazing, primarily in the major drainages of lower elevation country. Conversely, the winter-lowland/summer-highland pattern is the norm in areas where grazing predominates over farming and seasonal moves are made with respect to the availability of pasturage.

Thus, in the most general way, Navajo residential mobility is characterized by a biannual, dual residential pattern of mobility, corresponding roughly with gross topographic, climatic, and economic variables. While many individual community studies have shown these generalizations to be subject to refinement at a local level (see York 1983 for overview and discussion), the general studies illustrate that Navajo mobility is organized in a non-random manner, and that mobility has decreased over time.

In the Wupatki area, the availability of water has been recognized by various researchers as the primary determinant of Navajo mobility. Hoover (1931:440), for example, stated that

> "in the region west, toward the Little Colorado River, water is a more important factor in controlling migration than farther east . . . the shift is toward the timber in the winter months and toward the non-timbered sections in the summer, to seek land where small crops may be produced. . . . As the rains come the Indians move farther back to the higher and better pastures, whether it be summer or winter. As necessity demands they move to the places with permanent water. . . . Much of the western end of the reservation is quite desert and for the most part uninhabited; but in the summer time local showers cause the grass to spring up, and, as is characteristic of desert borders, the Navajos follow the showers seeking pasture for their flocks."

Jett (1978:441-442) also notes that

> "water availability [in the western Navajo area] is the paramount consideration in determining moves. Many desert grazing areas are (or were before wells were drilled) utilized only in summer when grass is relatively plentiful and potholes are full of water."

The history of Wupatki Navajo land use has shown that the ability of Navajo families to maintain flexible mobility among established residences was severely curtailed during the last century. With influxes of non-Navajo populations, competition increased over the few available water sources and limited good grazing land. Navajo mobility was dependent on the availability of grass and water, but at the same time, access to these resources was becoming limited by the presence of a growing Anglo population. The changes in Navajo settlement over the last 125 years are reflected in changes in the Monument's Navajo archeological record.

Mid-nineteenth-century seasonal occupation of the Grey Mountain/Little Colorado River region is evidenced by early archeological sites documented during the Navajo Lands Claims investigations. Tree-ring dates from the area date from as early as the late eighteenth century (Stokes and Smiley 1964:16-17). That this was a period of seasonal occupation for hunting and pinon gathering, as suggested by Ellis (1974:462), is supported by the presence of an antelope corral (W LLC C KK) slightly west of Wupatki (Indian Claims Commission 1962). Seasonal moves occurred during this early time period over an immense area

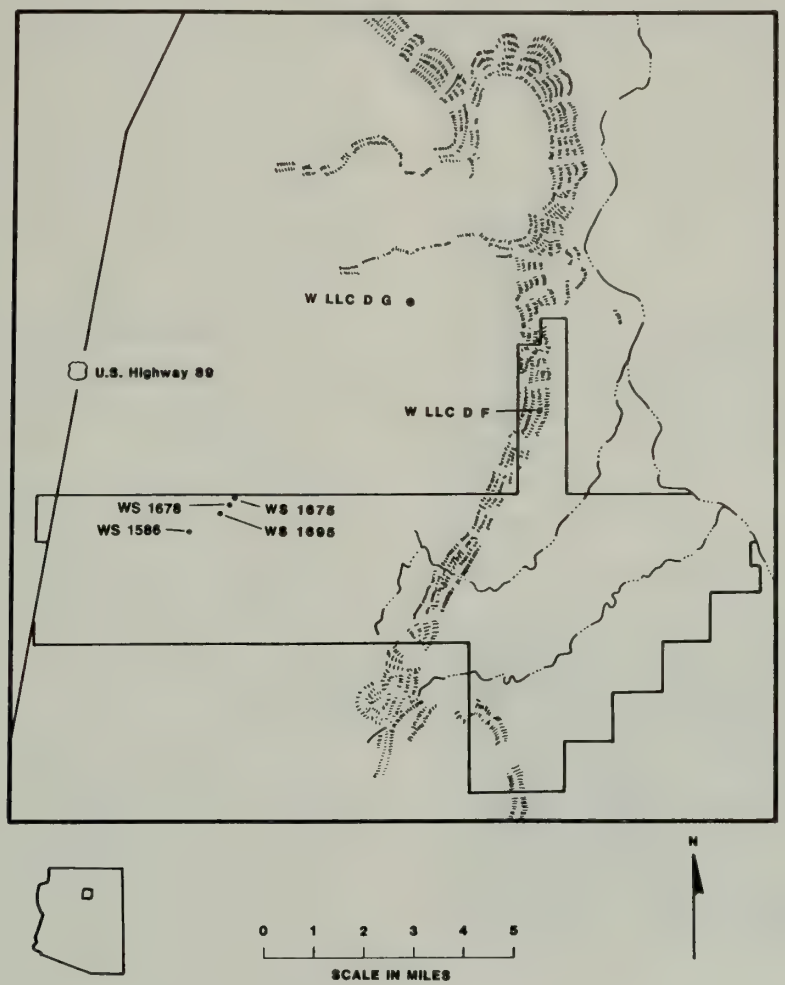


FIGURE 6.6. Locations of Fort Sumner Era Navajo Sites in Wupatki.

between Grey Mountain and Black Mesa, nearly 100 miles to the northeast. By the 1860s, according to Ellis (1974:468-478), drought forced Navajos west from the Hopi Mesa country, seeking the pinon crops of the San Francisco Mountains and the Coconino Plateau and the water offered by the Little colorado River. Archeological evidence from the Wupatki vicinity supports this position, indicating that moves no longer occurred between Black Mesa and the Coconino Plateau for hunting and pinon gathering. Rather, by the 1860s, mobility occurred between the Little Colorado River and the Grand Canyon area, focusing on sheep herding, agriculture and pinon gathering.

The earliest archeological evidence of Navajo occupation on or adjacent to the Monument itself comes from six sites dating to roughly the Fort Sumner period (1864-1868). Three sites previously recorded as

pre-Fort Sumner during the Navajo Land Claim investigations of the 1950s (Indian Claims Commission 1962), W LLC D F, W LLC D G, and W LLC D H (WS1586), were reidentified during the Wupatki Ethnohistoric Research Project. Three other sites located by the Wupatki archeological survey WS1695, WS1675, and WS1678, may represent either pre-Fort Sumner or early post-Fort Sumner habitation. These sites appear in the limestone canyons cut into the Antelope Prairie (Figure 6.7), and are associated with corrals and walls that indicate the use of the prairie for livestock grazing.

The use of the Antelope Prairie for sheep grazing was complemented by agricultural activities on the Little Colorado

FIGURE 6.7. Pre-Fort Sumner Site, WS 1586 (WLLCDH). Photo by Klara Kelley, 1985.

River floodplain. Hogans established prior to 1864 in Section 9 at Black Point were reoccupied by Peshlakai Etsidi's wife's family following Fort Sumner. The hogans of seven nuclear families at the Black Point fields became the primary nucleus of summer settlement in Wupatki during the turn of the century.

For the next 30 years, the Wupatki Navajos' yearly economic cycle encompassed moves within a 25- to 30-mile span from the area of Deadman's Wash on the south to upper Grey Mountain on the north. Seasonal use was made of residences in Deadman's Wash and its tributaries (WS303, WS314, WS745, WS1514, WS1515, components of WS2293, WS1489, WS1848), the base of the Kaibab limestone monocline in section 29 of the northern Wupatki basin (sites included among WS770, WS773, WS766, WS767, WS825, WS815, WS816, WS841), Antelope Prairie (W LLC D E), Black Point, and Grey Mountain (Figure 6.8). While kinship ties remained on Black Mesa and economic relationships existed south of the Wupatki basin in the Leupp area, coresidential groups moved together primarily between the Wupatki basin and Grey Mountain. Antelope Prairie and Black Point were used during the spring and summer months for grazing and agricultural activities respectively. The winter months were spent on Grey Mountain, where snow provided the water that had disappeared from the lower elevations and firewood was abundant.

Thus, from the 1860s to the 1930s, the patterns of seasonal movement in the Wupatki area corresponded to the general mobility pattern suggested by Hoover for the western Navajo territory; summer months were spent on the Little Colorado River lowlands for agricultural purposes, while winters were spent in the Grey Mountain highlands for the availability of water and firewood. As the population grew, however, smaller nuclear families separated some of their seasonal movements, initiating small customary use areas that would take shape during the 1930s. The residence groups previously engaged in communal seasonal moves began to disband, establishing separate family use-areas on a much smaller scale (D.N.A. n.d.).

The division of large coresidential groups into smaller groups after 1929 may have been the result of several factors. As pointed out by Lamphere, residence groups undergo a three-stage process of expansion, fission, and re-expansion of the new group.

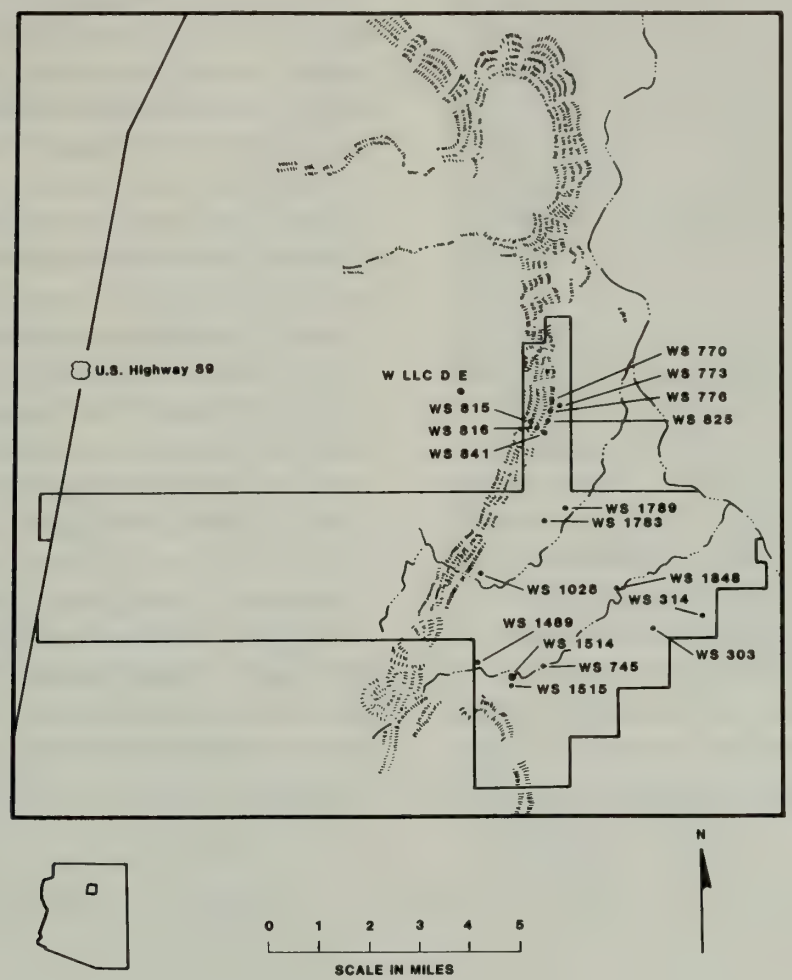


FIGURE 6.8. Locations of Residences Occupied circa 1880-1930 (for which temporal data are currently available).

In the fission stage, according to Lamphere (1977:77):

> One or more of the younger couples move off to found new camps as couples move off to become economically self-suficient. The new residences are usually located within a few miles of the parent camp and often within its previous grazing territory. During this period, one or both parents may die, and one or two of the children with their families may remain at the parent camp area to retain control of the land and other resources. While the Navajo often abandon or destroy dwellings after the death of inhabitants, they usually do not abandon the area the family controls for grazing. New units produced by the moving off of middle-aged couples and their children are camps reduced to their smallest proportions: the nuclear family household.

Adams (1986) noted the occurrence of the same process at Shonto in 1955. In a sample of 38 residence groups, 80% con-

tained two, three, or four households, while only one residence group had more than four households. In addition, approximately 80% of the residence groups were compassed of 10 to 20 individuals, while only three groups contained more than 20 and none had more than 29. Adams suggests that residence groups reach a size threshold, after which they break down into smaller cooperative units.

Population growth was continuing among the Wupatki Navajos, contributing to the breakdown of large, cooperative residence groups into smaller units. According to elderly residents, however, the single event resulting in a breakdown of the large cooperative groups was the final disposition of Navajo families from the Antelope Prairie in 1929 (Roberts 1985 field notes, D.N.A. n.d.). With the loss of access to antelope Prairie, mobility within a contiguous region from the Wupatki Basin to Grey Mountain was disrupted. Nuclear families of Peshlakai Etsidi's extended kin group moved permanently to Grey Mountain or east of the river, while others moved south permanently into the Wupatki basin.

Table 6.2 illustrates the size of human and animal populations present in the Wupatki basin from the early 1930s on, according to various sources. The table presents figures provided only for the Wupatki basin itself and not for surrounding areas, although these figures should not be interpreted as representing stable populations in the basin on a year-round basis. Many of the observations were made at points in time and do not reflect movement of both people and animals on and off the Monument during the year, nor do they necessarily account for the combining and splitting of family herds. The differences between actual numbers of livestock, "sheep units," and "animal unit months" should also

TABLE 6.2. Navajo and Livestock Populations in Wupatki between 1934 and 1971.

YEAR	NAVAJO INDIVIDUALS	LIVESTOCK	RANGE CAPACITY
1934	-------	300 sheep 72 goats	------
1935	c. 30	256 sheep & goats*	------
1936	c. 30	149 sheep 20 horses 22 goats*	------
1937	c. 40**	-------	------
1941	c.20	-------	------
194?	-------	370 sheep 16 horses	------
1945	-------	500-700 sheep	------
1946	-------	573 sheep units	360 sheep units/year
1947	20 + children	823 sheep units	------
1948	-------	671 sheep units	------
1948	-------	573 sheep	------
1958	20-30	-------	------
1969	-------	225 sheep*	------
1971	-------	-------	1783 AUM***
1971	-------	-------	330 sheep unit/year

* Reported from one household.
** 40 of Peshlakai Etsidi's descendants between Coconino Point and Wupatki Basin.
*** Animal unit months (one sheep unit for 30 days).

be noted. While the population figures recorded in the Monument over the years are sparse, they do indicate that a substantial number of people and livestock confined to 16,320 acres of poor forage in the Wupatki basin would require adjustments in patterns of movement.

Populations suddenly confined to the basin lowlands were prevented from moving permanently in any direction out of the basin. The northern prairie had been claimed by Anglo ranchers. Lands to the south and to the north and east on the reservation side of the river were already filled by other Navajo families. The 386,000-acre Leupp extension was filled beyond capacity by 1904, supporting 400 individuals with poor grazing and inadequate supplies of water. Only 25,000 acres of the Leupp extension were potentially irrigable at the time it was set aside, and approximately 257,000 acres would have provided good grazing had water been available (U.S. Commissioner of Indian Affairs 1904). Navajo families had been confined to the barren "Leupp extension" even earlier than in the Wupatki basin, following the 1899 battles between Anglos and Navajos in Canyon Padre. Reverend Johnston of the Tolchaco Mission had advised one local headman at the time to move his family to the reservation side of the river:

> The Navajo explained patiently that there was no room for him there. All the range north of the river was occupied by well-entrenched families with rights established by long occupancy. To take the missionary's advice would mean to become a trespasser on lands belonging to his own people (B. Johnston 1972:96-97).

Thus, by the time approximately 30 to 40 people and 400 animals moved into the Wupatki basin in the late 1920s to early 1930s, it was virtually impossible for them to expand in any other direction. Each family's entire yearly subsistence cycle had to be accommodated to small portions of their formerly large range. Peshlakai Etsidi's second- and third-generation offspring formed nuclear family groups which developed into specific use areas between the 1930s and the 1950s. During this peak period of Wupatki's Navajo occupation, greatly reduced family land use-areas developed in response to changes in demographics, resource availability, and Monument boundaries.

When the Monument boundaries were enlarged in 1937 from 2,234 acres to over 25,865 acres, the use-areas of four large Navajo residential groups became part of the Monument (Euler 1949; NPS n.d.). Three of the use-areas belonged to the families of Peshlakai Etsidi's sons and one to the family of Etsidi's step-granddaughter. Each of these use-areas is referred to here by the clan name of the female head of the residence group at the time of the Monument enlargement.

Peshlakai Etsidi's step-granddaughter's family retained use of the Tsenjikini area in the southern portion of the basin. This use area was beginning to be defined after the turn of the century, and by the 1930s, included an area from the wooded lands south of the Monument boundaries, slightly east of the river near Black Falls, to Heiser Wash in the southern Monument. The remaining families used the central and northern basin on a year-round basis, although some members of one group moved east of the river during the winter months. The hogans in Section 29 in the northern basin between the prairie and the river (WS770, WS772, WS766, WS767, WS825, WS815, WS816, WS841) were still used communally by various nuclear families during the agricultural season as they had been for decades (Figure 6.9). Livestock grazed in the northern and central basin, but no longer on the

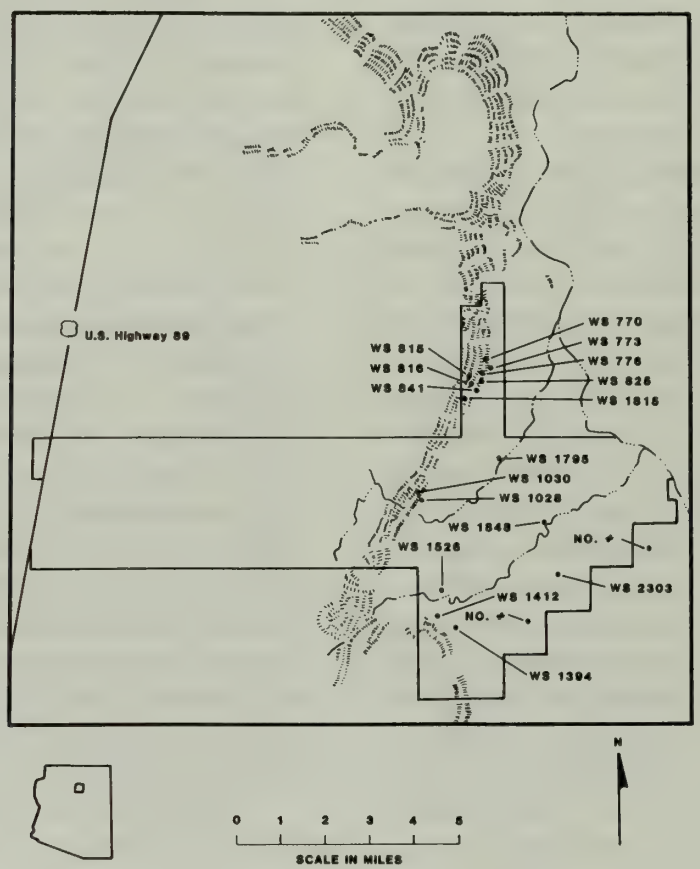


FIGURE 6.9. Locations of Residences Occupied circa 1930-1940s (for which temporal data are currently available).

prairie, as evidenced by the presence of walls constructed in the canyons connecting the Antelope Prairie to the basin. According to local residents, family groups from both Wupatki and Grey Mountain united in the northern basin along the river during the agricultural months and split up again during the winter to their respective use areas. Families who had brought their sheep into the basin from Grey Mountain for the summer returned to Grey Mountain when water became available, while the Wupatki families moved south into the basin.

Seasonal movement was dependent on the availability of water, and in Wupatki, water was provided by three primary sources. Wupatki Spring became the primary water source after its development in the early 1930s, in addition to Ma'ii To' (a man-made rain catchment reservoir in the central basin) and the Little Colorado River.

Heiser Spring, a fourth major water source which had been used by Navajos prior to the arrival of Anglo ranchers, was under private control by non-Navajo sheepherders by the 1930s and was inaccessible to Navajo use (Sallie Brewer Harris, personal communication 1984; Roberts interview notes, 1985). Water in any of these sources depended on the amount and timing of rainfall, as did the availability of forage. Navajo mobility remained as flexible as possible under the circumstances to accommodate variability in available resources.

By the 1940s, however, Navajo mobility was further curtailed by a series of reductions in available range. The 1937 Monument expansion had not included Section 29 in the northern basin, containing the communal agricultural hogans. This section remained under private, non-Navajo ownership until another land exchange in 1961. In about 1941, Anglo cattle ranchers permanently removed Navajos from their summer hogans in Section 29. At the same time, range conservation measures were being implemented by the NPS, requiring Navajos to move out of the Monument entirely during the summer months to permit regeneration of the grass. Some nuclear families split off from the larger residence groups permanently during this time to form new residence groups or join existing groups off the monument. Thus, by the 1950s, Navajo use of the Monument included only the area south of Antelope Wash. Despite increases in the numbers of Peshlakai Etsidi's descendants, the Navajo population on the Monument included only 20 to 30 individuals (Bullard 1958). This population consisted of small nuclear families of the previously large residential groups, occupying three of the four former use-areas (Figure 6.10).

Mobility varied slightly within each of the use-areas. In the Tsenjikini area, seasonal moves occurred in a regular order among three primary residences in the basin (WS306, WS2293, and one unnumbered location) and one residence east of the river. Seasonal moves in the Tabaahi use-area did not occur regularly as in the Tsenjikini area, but varied among several locations (WS1813, WS1710, WS1461, WS1836, WS1839, WS292) as the availability of resources permitted. Within the Tl'izi lani area, summers were spent south of the Monument in camps near Woodhouse Mesa, while winter occupancy fluctuated among residences including WS1526, WS1417, WS1394, WS2303, WS687, and an unnumbered site. The patterns of movement thus varied within each use-area, including either regular or sporadic moves among sets of fixed residential locations, depending on the availability of resources.

By 1964 the Monument had been abandoned by all but one family. During the following decade, their use-area also decreased, due to changes in the composition of the family and restrictions imposed by the NPS Service (Figure 6.11). The use of sheep camps at WS1462 and WS282 was terminated, and the winter residence at WS1526 was abandoned following the death of the male head of the household. A residence was constructed at WS2283, while the unnumbered residence and WS687 were used during spring and summer respectively. The family was required in the mid 1970s to move location WS2283 to WS2298, which burned down several years later. Since the closing of the road to WS687, the family has remained year-round at the unnumbered residence, a location that has been occupied sporadically since the 1930s during winter, spring, and finally, year-round.

Within a period of about 120 years, Navajo use of Wupatki has changed from sporadic, seasonal use for hunting and gathering, to intermittent use for grazing

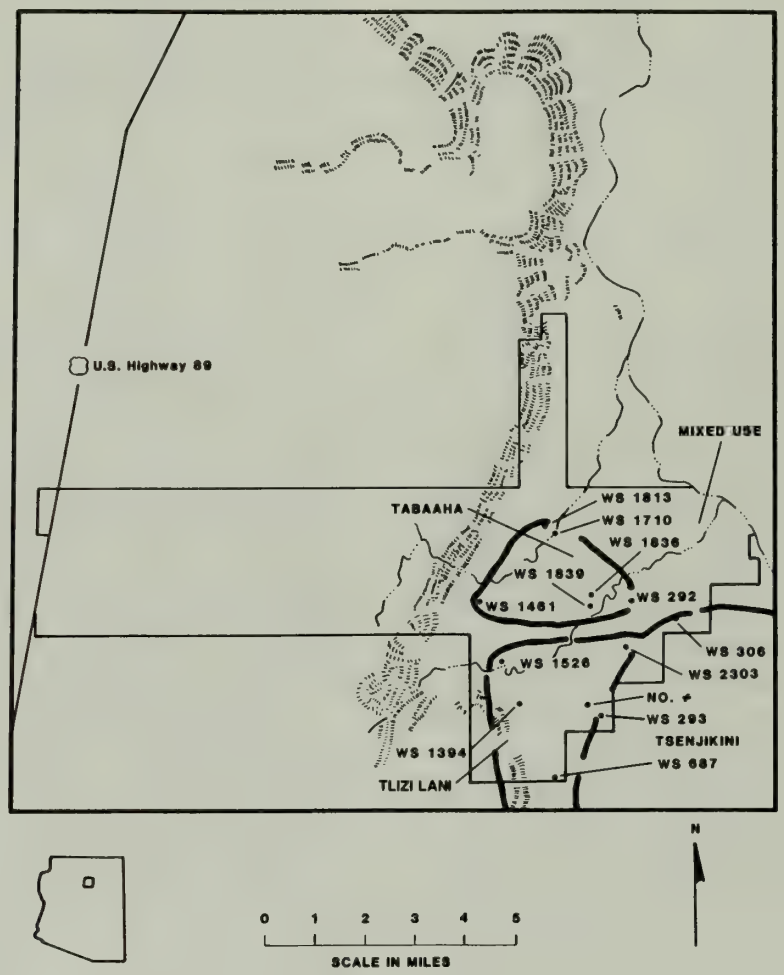


FIGURE 6.10. Family Use Areas, circa 1950-1964 ("use-areas" refers to the extent of residential locations, not the extent of grazing).

and agriculture during flexible yearly mobility cycles' to intensive use by a concentrated population, to permanent settlement at a single homesite. The material result of these changes is an archaeological record of over two hundred historic sites distributed across the monument. The complexity of changing settlement that has resulted in the current distribution of sites suggests that a "settlement pattern analysis" based solely on the archaeological record within the Monument boundaries would have been misleading. Not only has Navajo settlement extended well beyond the current Monument boundaries, but the seasons of use have changed over time, along with site function in some cases. Assigning each site to a specific temporal/functional category and then reconstructing a "settlement system" from the classification would not have accounted for the actual variability in settlement behavior over a long period of

time that has resulted in the contemporary archeological record. The full range of historic archeological sites is presented in the following discussion.

An Inventory of Wupatki's Historic Archeological Record

Of the 224 historic sites and site components recorded on the Monument, not all can be attributed to the Navajo occupation. Historically, Wupatki has been used by Hopis, Anglo ranchers, miners, pothunters, the National Park Service, the Civilian Conservation Corps, archeologists, geologists, cave researchers, Basque sheepherders, traders, film makers, and tourists. Therefore, only those sites identified by former Navajo occupants of the Monument or those considered diagnostic of a seasonally mobile, pastoral adaptation (e.g., hogan sites, sweat lodges, and livestock management facilities) were assigned Navajo cultural affiliations. The remaining sites, including historic petroglyphs, some livestock management facilities, some water control features, and dumps, were considered to be of a problematic historic cultural affiliation. The historic sites are therefore grouped into the following categories: Navajo residential sites, isolated sweat lodges, temporary camps, isolated livestock management facilities, water-control facilities, isolated dumps, historic petroglyphs, sites related to Black Falls Crossing, historic sites of unknown function, and miscellaneous "other" historic sites. The spatial associations of some sites to one another also proved problematic in the field. Several sites that were recorded separately by the archaeological survey crew were found to be associated during the interviewing process. For data management purposes, the site numbers of individual sites as they were recorded in the field are retained, and any associations with other sites are noted. Each site category is discussed separately below, including a list of sites and a site distribution map for each category.

Navajo Residential Sites

Seventy-two Navajo residential sites were located within or adjacent to the Monument boundaries. (Only the 67 sites located within the Monument boundaries were included in the Wupatki Archeological Survey site inventory; the remaining five are not added into the site totals presented here.) Residential sites comprise the largest category of historic sites on the Monument, and provided the basis for the ethnohistorical study. For the purposes of this analysis, residential sites were defined as those containing dwelling structures (hogans or houses) or their foundations, and associated features. Temporary camps, conversely, were defined as those sites containing evidence of temporary occupation (i.e., hearths) and associated features, but lacking dwellings.

This categorization is problematic for several reasons, but primarily due to the fact that residences containing dwellings may be occupied for short periods of time, while "camps" containing only tents or brush structures may be occupied for an entire warm season. This variability in duration of use may be further complicated by numerous occupations of a single location during which various kinds of structures may be built and dismantled over several episodes of use. Site WS422, for example, was initially constructed as a fall sheep-herding camp with a small stone dwelling. The structure was later dismantled and replaced by tents and occupied during both summer and

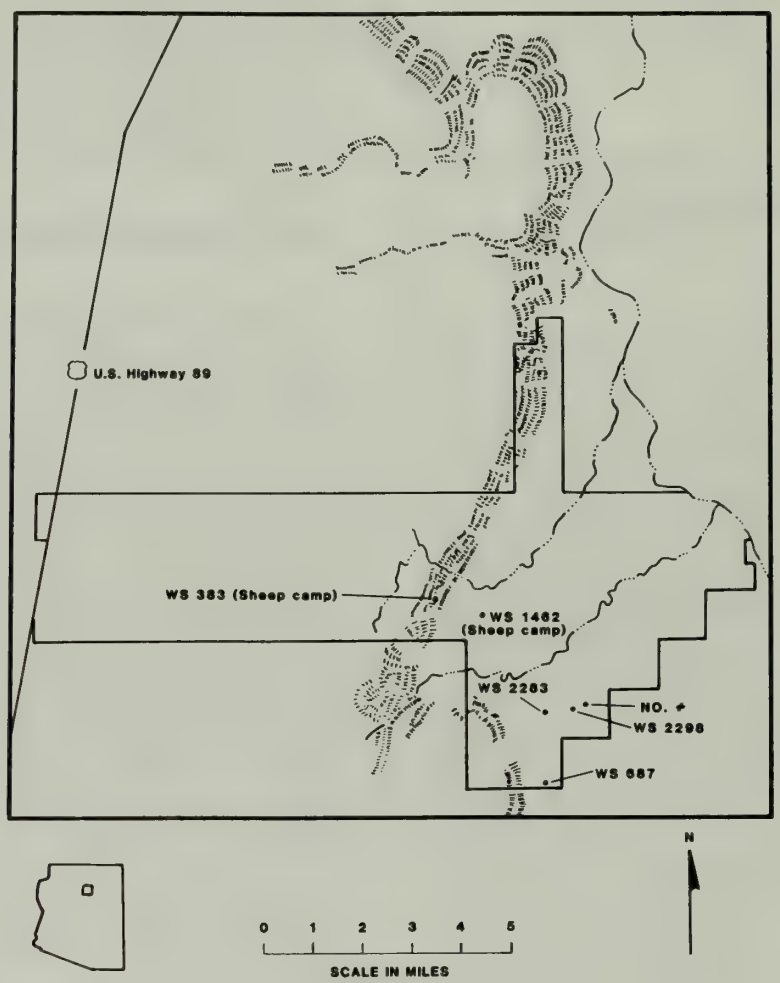


FIGURE 6.11. Locations of Navajo Use, circa 1964-1979.

winter. This kind of re-use was also common with the hogan sites in section 29 of the northern basin, where old roofless hogans were re-used temporarily during agricultural seasons with only brush coverings or no roofs at all.

Thus, there is a fine line between a "residence," presumably representing extended occupation, and a "camp," presumably representing short-term occupation. For the purposes of the ethnohistorical study, however, the development of a site typology was not an initial goal. Residences were considered a preliminary category because it was felt that dwelling sites would yield the greatest amount of ethnographic information for an initial ethnohistory and land-use analysis.

Furthermore, the grouping of all dwelling sites into a single "residential" category was intended to avoid the use of seasonal labels prior to the interviewing process.

Numerous Navajo site typologies are designed so that the season or seasons of site use can be inferred from the structures present (see Roberts 1984, 1986 for discussion). In this kind of typology, hogans are frequently assumed to be indicative of winter occupation, while brush structures or tents are presumed to indicate summer occupation. It was intended at the outset of this project, however, to make no judgements as to season of site use prior to the interviewing process. The site typology could then be constructed subsequently, based upon correlations between archaeological patterns and ethnographic data. As it turned out, the ethnographic information indicated even more flexibility in the seasons of use of residential locations than originally anticipated. An apriori seasonal classification would have been much too confining to account for the actual variability in land use. Future ethnoarcheological research with these data are discussed in Management Recommendations and Future Research below.

Data collected from former Navajo and Anglo residents of the Monument, in addition to archival sources, resulted in historical information for 59 of the 72 residential sites (82%). While 100 tree-ring samples were collected from 21 sites in 1984, only three dates were produced (Sites WS687, WS686, and WS767). The structural wood available for sampling was almost entirely juniper, which provided too erratic a ring series to be dated against a master chronology (Jeffrey S. Dean, personal communication to Bruce Anderson 1985). Thus, historical information was derived from ethnographic, archival, and artifact data. The results provided the basis for analyzing changes in Navajo land use over the last 120 years. Table 6.3 lists all residential sites within and adjacent to the Monument boundaries by site number, in addition to a brief location and historical description of each site. Site numbers assigned to some sites during previous studies are also noted. The distribution of residential sites within the study area is illustrated in Figure 6.21. Figure 6.12 through 6.20 illustrate comparisons of sites as they appeared historically and today as archeological sites.

Isolated Sweat Lodges

While many of the residential sites discussed above contain sweatlodges, nine sweat lodges were recorded as "isolated" when their associations with specific residential locations were determined to be problematic in the field. Interviewing subsequent to archeological recording clarified the relationships of several of the sweat lodges to residential sites. The nine sweat lodges recorded as isolated are listed in Table 6.4, with location information and associations to residential sites noted. The locations of the sites in this category are illustrated in Figure 6.22.

Temporary Camps, Livestock Management Facilities, and Historic Water-Control Facilities

The majority of temporary camps and livestock management and historic water-control facilities are related to Navajo livestock-grazing activities. The presence of Anglo cattle ranchers and sheep herders other than Navajos during the historic occupation of the Monument, however, makes the cultural affiliations of some of these sites problematic. Wupatki Pueblo was used in the 1880s, for example, by sheepherders employed by C.M. (or C.H.) Schultz, who at one time ran the most extensive sheep operation in Arizona (Hartman and Wolf 1977:24). The Babbitt Brothers' Co Bar

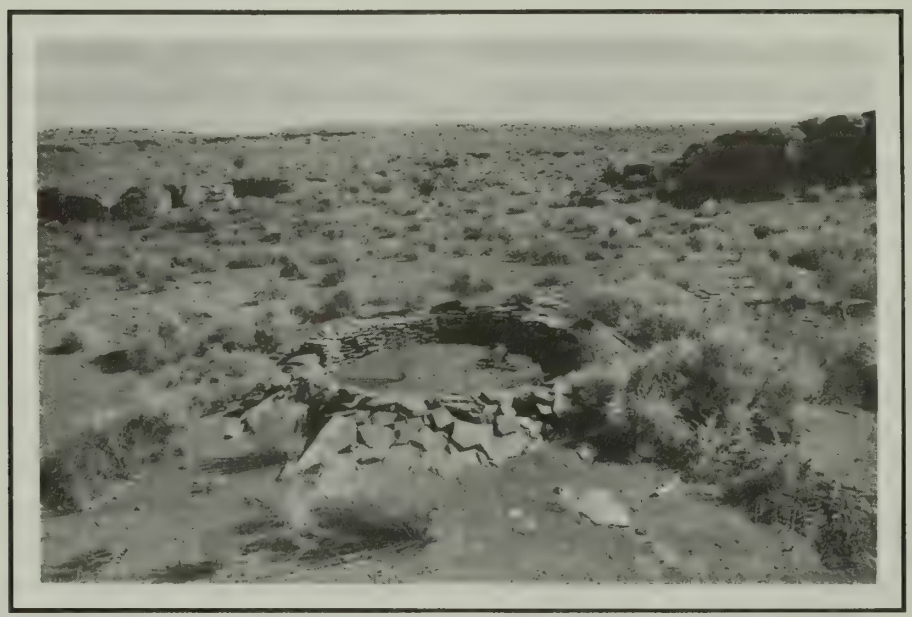


FIGURE 6.12. (a) Site WS 1815 as it appears archeologically in 1985, and (b) in use circa 1935. Photo (a) by Alexa Roberts in 1985, and (b) by Sallie Brewer circa 1935, courtesy of the Museum of Northern Arizona (MS242-2-29).

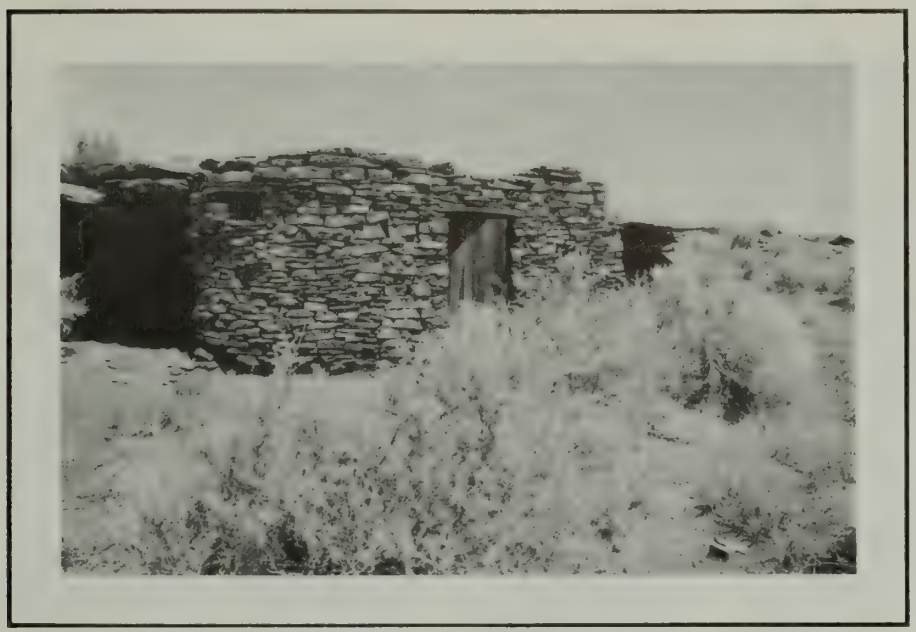


FIGURE 6.13. (a) Un-numbered site as it appears archeologically in 1985, and (b) in use between 1934 and 1936; this site was referred to by the residents as "Hopi House". Photo (a) by Alexa Roberts, 1985, and photo (b) Jim or Sallie Brewer, 1934-1936 (MS242-2-12).

FIGURE 6.14. (a) WS 1848 as it appears in 1985, and (b) in use circa 1935. Photo (a) by Alexa Roberts, and photo (b) by Sallie Brewer, circa 1935, courtesy of the Museum of Northern Arizona (MS242-2-33).

FIGURE 6.15. (a) Site WS 816 as it appears archeologically in 1985, and (b) it's appearance circa 1934-1936 (note repairs and additions to structure since 1930's). Photo (a) by the Wupatki Archeological Survey, and photo (b) by Sallie Brewer, courtesy of the Museum of Northern Arizona (MS242-2-30).

FIGURE 6.16. (a) Corral on site WS 2293 as it appears in 1985, and (b) in use in 1954. Photo (a) by Alexa Roberts, and Photo (b) courtesy of Mrs. Elsie Tohannie.

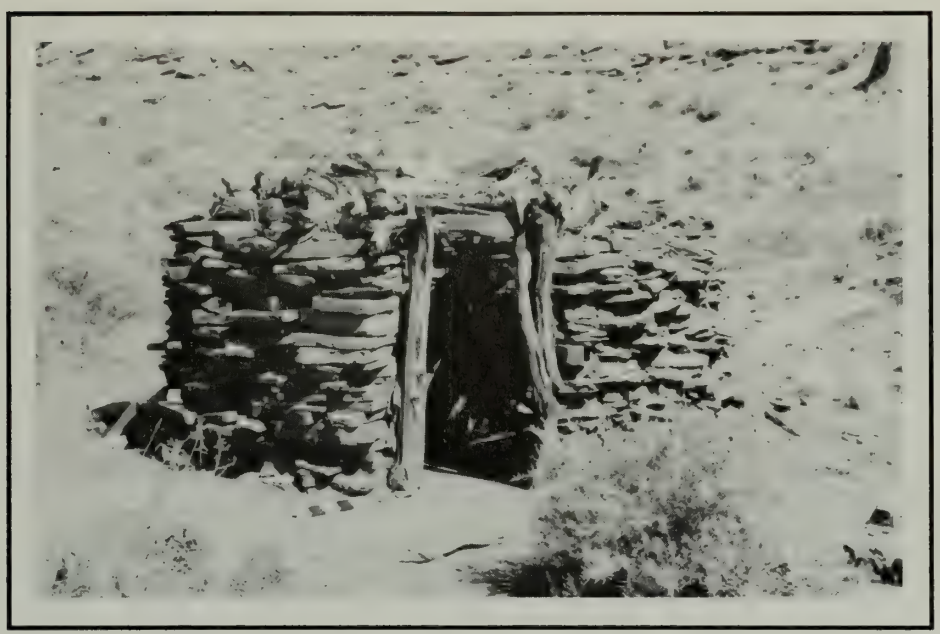


FIGURE 6.17. (a) Site WS 1028 (NA14,580) in 1985, and (b) in 1954. Photo (a) by the Wupatki Archeological Survey, and (b) by William Bullard, on file at Wupatki National Monument.

FIGURE 6.18. (a) Site WS 767 in 1984, and (b) in 1954. Photo (a) by Alexa Roberts, and (b) by William Bullard, on file at Wupatki National Monument.

FIGURE 6.19. Unnumbered site in 1984 (a), and in 1954 (b). Photo (a) by Alexa Roberts, and photo (b) by William Bullard, on file at Wupatki National Monument.

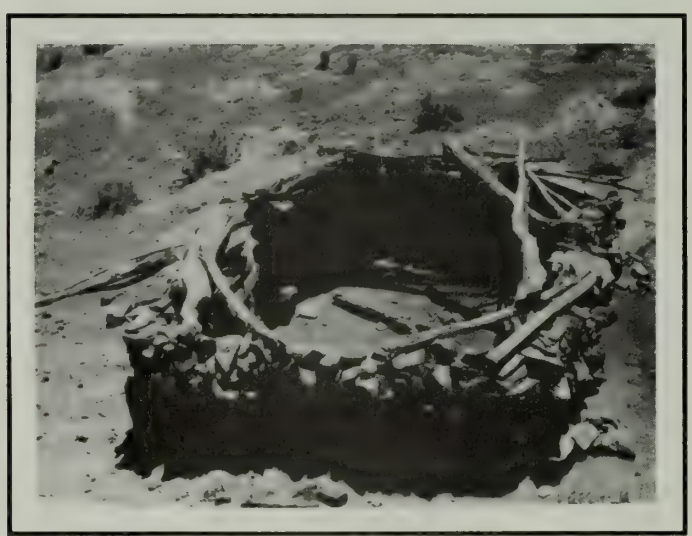


FIGURE 6.20. Site WS 766 in 1984 (a), and in 1954 (b). Photo (a) by the Wupatki Archaeological Survey,

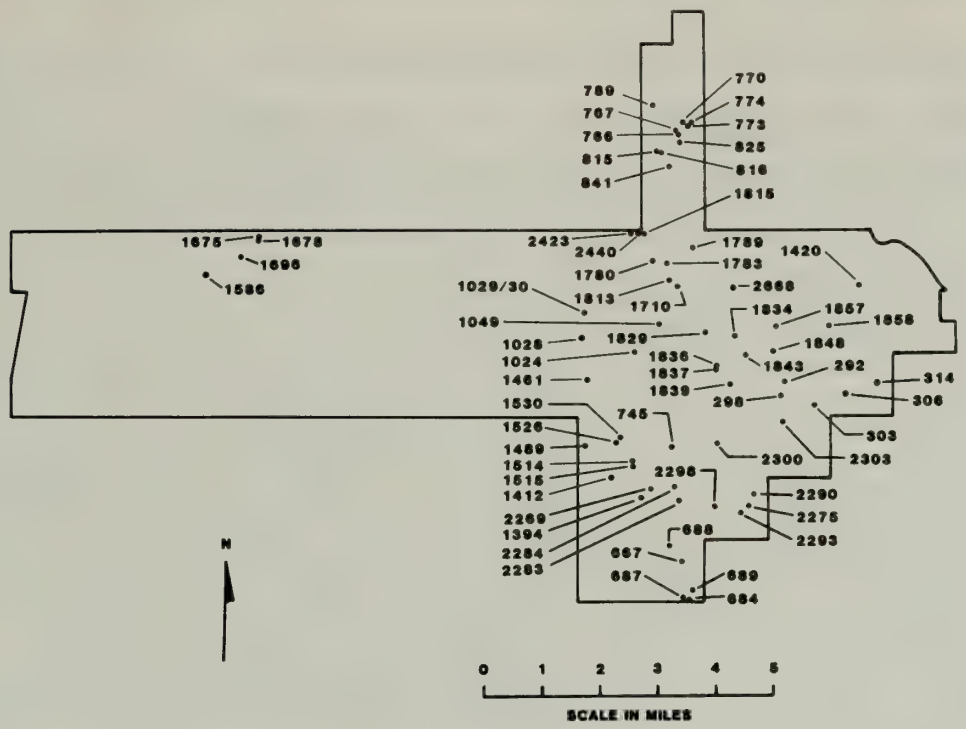


FIGURE 6.21. Distribution of Navajo Residential Sites.

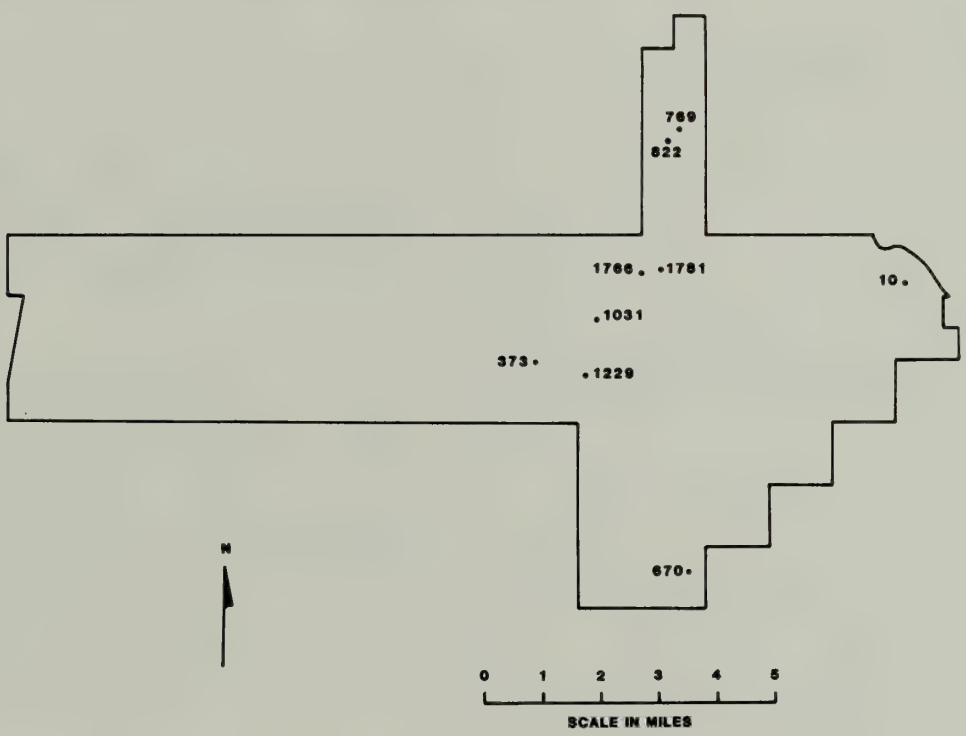


FIGURE 6.22. Distribution of Isolated Sweat Lodges.

TABLE 6.3. Locations and Historical Contexts of Navajo Residential Sites.

SITE #	LOCATION	DESCRIPTION
WS 292	T25N R10E SEC 15	Occupied seasonally during 1950s by Tunney family.
WS 298	T25N R10E SEC 15	Hogan in which Etsidi's granddaughter died, 1941. The girl was buried by the CCC in the same hogan in which Peshlakai Etsidi died (WS 1024). Hogan 298 was burned.
WS 303	T25N 410E SEC 15	Built by P, Etsidi or L. Johnson, used c. early 1900s. This area was used by the generation preceding Alma Boone and Lucy Grebb, both of whom were born in about the 1910s.
WS 306	T25N R10E SEC 14	Long-term seasonal residence of Grebb family, from about 1930s to 1960s
WS 314	T25N R10E SEC 14	Used by Etsidi or Cody, c. 1920s.
WS 667	T25N R10E SEC 32	Hogan used by Clyde Peshlakai, c. late 1950s-1960s. previously recorded by Anderson, 1977. Assoc. with WS670
WS 684 WS 686	T25N R10E SEC 32	Foundations of houses used by members of Peshlakai family after 1963
WS 687	T25N R10E SEC 32	Long-term seasonal residence of Peshlakai family used 1950s-1977.
WS 688	T25N R10E SEC 32	Used post-1963 by Peshlakai family.
WS 689	T25N R10E SEC 32	Used post-1963 by Peshlakai family.
WS 745	T25N R10E SEC 20	Mary Boone born here, 1926. Area used by Alma Boone's family prior to 1920s.

TABLE 6.3. (continued)

SITE #	LOCATION	DESCRIPTION
WS 766 WS 767 WS 770 WS 773 WS 774 WS 789 WS 815 WS 816 WS 825 WS 841	T26N R10E SEC 29	Large complex of sites used by various families during agricultural seasons from pre-Fort Sumner period (cf., 1952 lands claims records, site W LLC D F). One tree-ring date of 1945 obtained from WS767 during Phase I of ethnohistory project. Between 1945 and 1949, ranchers permanently removed families from section 29. Section 29 was privately owned until a 1961 land transfer made it part of the Monument. Bullard recorded WS 767 as Hogan #2 and WS 768 as Hogan #7 in his 1952 photographic inventory.
WS 1024	T25N R10E SEC 7	Burial place of Peshlakai Etsidi, 1939. Three others buried here subsequently.
WS 1028	T25N R10E SEC 7	Used 1910s-1920s by Big Ben. Identified by MNA as NA 14580.
WS 1029 WS 1030	T25N R10E SEC 7	Associated with WS1030. Used by extended family of Peshlakai Etsidi from the 1910s into the 1940s. Recorded by MNA as NA15581 and by Bullard as Hogans #4 and #5 (1952).
WS 1049	T25N R10E SEC 8	1940s artifacts, use history unknown
WS 1394	T25N R10E SEC 30	Seasonal use by Peshlakai family from 1930s through 1950s
WS 1412	T25N R10E SEC 30	MNA Ceremonial Show hogan (cross-listed with "other" site category). Became a residential site for Clyde Peshlakai after the 1936 show, was abandoned and dismantled for firewood in late 1950's. MNA site # NA14584.

TABLE 6.3. (continued)

SITE #	LOCATION	DESCRIPTION
WS 1420	T25N R10E SEC 2	Used seasonally (summer) by members of Grebb family, 1950s-1960s.
WS 1461	T25N R10E SEC 18	Site used seasonally by Jerry Tunney and family during the 1950s and 1960s. Associated with sweathouse, WS1229.
WS 1489	T25N R10E SEC 19	Early use, possibly c. 1910s/1920s. Possibly used by Mr. Norman Cody.
WS 1514 WS 1515	T25N R10E SEC 19	Probably associated with WS1515. Use history unknown, but appears early, c. turn of century.
WS 1526	T25N R10E SEC 19	Long-time residence of Clyde Peshlakai and family. Rock house constructed in 1939, modeled after the new superintendents quarters constructed by NPS Occupation of the site dates earlier, possibly 1920s (Mercer p.c.). WS1530 represents the earlier occupation. Clyde was buried in the rock house in December 1970, and the site was permanently abandoned.
WS 1586	T25N R 9E SEC 6	One of the few pre-Fort Sumner sites on the monument, recorded for the Lands Claims by VanValkenburgh as W LLC D H, 1952. Also recorded as NA 2898 by Museum of Northern Arizona.
WS 1675	T25N R 9E SEC 6	Fort Sumner era, probably used by Etsidi (Euler, p.c.; Big Ben, p.c.).
WS 1678	T25N R 9E SEC 6	Same as WS1675, probably associated.

TABLE 6.3. (continued)

SITE #	LOCATION	DESCRIPTION
WS 1696	T25N R 9E SEC 6	Same as 1675 and 1678--complex of early features probably used by Etsidi. Visible in 1908 photograph by Fewkes, abandoned. Tree-ring dates from Lands Claims investigations of 1903 and 1911 (W LLC D A), indicating site reuse.
WS 1710	T25N R10E SEC 5	Used seasonally (winter), by Smith family and later by Tunney family, c. 1930s-1950. Bullard's Hogan 3, 1952.
WS 1780	T25N R10E SEC 5	Apparently early, but history unknown.
WS 1783	T25N R10E SEC 5	Probable 1920s seasonal residence of Mark Anthony family.
WS 1789	T25N R10E SEC 5	1940s artifact dates, history unknown.
WS 1813	T25N R10E SEC 5	Used by Tunney family simultaneously with WS1461.
WS 1815	T25N R10E SEC 5	Large complex used over long period of time by extended family of Etsidi, especially Lee family. Apparently occupied from early 1900s to late 1930s/early 1940s. One burial at this site.
WS 1829	T25N R10E SEC 9	Occupation dates unclear, apparently 1930s. Etsidi's great-granddaughter died here; place of burial unclear.
WS 1834	T25N R10E SEC 9	Pre-1920s artifact dates, use unknown.
WS 1836	T25N R10E SEC 16	Seasonal residence of Tunney family, hogan under construction late 1950s when family vacated the monument.

TABLE 6.3. (continued)

SITE #	LOCATION	DESCRIPTION
WS 1837	T25N R10E SEC 16	Residence used by the parents of Mrs. Tunney when she was young, c. 1930s.
WS 1839	T25N R10E SEC 16	Winter residence used by family of Mrs. Tunney prior to her marriage and by her and her husband subsequently. Used in winter along with WS 1461. Last used about 1960s.
WS 1843	T25N R10E SEC 9	Post 1940s trash, use history unknown.
WS 1848	T25N R10E SEC 10	Residence of Peshlakai Etsidi and extended family from 1910s/ 20s into late 1930s. Associated with large agricultural field in canyon bottom.
WS 1857	T25N R10E SEC 10	C. 1920s trash, use history unknown.
WS 1858	T25N R10E SEC 10	Occupation dates/use history unknown.
WS 2269	T25N R10E SEC 29	Occupation dates/use history unknown. Possibly part of WS 1394.
WS 2275	T25N R10E SEC 28	Recorded as a walled in rock shelter (cross listed with category "other"), this feature is probably associated with a hogan foundation at the base of the rock shelter. Hogan recorded as structure "E" of site WS 2293. The site is early, but its use history is unknown.
WS 2283	T25N R10E SEC 29	Current resident of the monument had a frame house at this site after 1970, and moved it to WS 2298 in the mid 1970s.

TABLE 6.3. (continued)

SITE #	LOCATION	DESCRIPTION
WS 2284	T25N R10E SEC 29	The residence at WS 1394 was moved here in about 1959 after the structural elements of the hogan began rotting. Used until mid-1960s.
WS 2290	T25N R103 SEC 28	Multi-component site, including an early residential component, overlain with more recent trash from WS 2293. The early residential component includes a hogan base recorded as Structure "G" of WS 2293. The use of the early component is unknown.
WS 2293	T25N R10E SEC 28	Large, long-time seasonal residence of the Grebb family, occupied from about the mid-1940s to the mid-1960s. Used for about six months each winter.
WS 2298	T25N R10E SEC 28	The location to which the frame house at WS 2283 was moved in the mid-1970s. The house burned down in 1977 and the site was abandoned.
WS 2300	T25N R10E SEC 22	The body of Clyde Peshlakai's half brother-in-law was buried in the hogan at this site in the winter of 1934/1935.
WS 2303	T25N R10E SEC 22	Seasonal residence of Clyde Peshlakai and family from about the mid 1930s to the early 1960s. Used generally in the winter. Associated with WS 2304 & 2305.
WS 2423	T25N R10E SEC 6	Trash dates and location indicate that this site is probably part of WS 1815.
WS 2440	T25N R10E SEC 6	Occupation dates, use history unknown.

TABLE 6.3. (concluded)

SITE #	LOCATION	DESCRIPTION
WS 2668	T25N R10E SEC 4	1940s/1950s trash, use history unknown.
NO WS #	T25N R9E SEC 13 (off monument)	Primary residence of the Grebb family, possibly used from as early as the 1910s/1920s until the early 1950s.
NO WS #	T26N R9E SEC 14 (off monument)	Pre-Fort Sumner site recorded during 1952 land-claims investigations as W LLC D G.
NO WS #	T26N R9E SEC 24 (off monument)	Site on allotment granted to family of Peshlakai Etsidi in 1908 and used until late 1920s when evicted from Antelope Prairie. Recorded during land-claims investigations as W LLC D E.
NO WS #	T25N R10E SEC 13 (off monument)	Hogan containing the burials of three of Etsidi's great-grandchildren, who died at the same time during the 1930s. Bullard's Hogan #12.
NO WS #	T25N R10E SEC 28 (off monument)	Possible burial hogan of Grandmother Peshlakai, buried in 1947.

TABLE 6.4. Locations and Descriptions of Isolated Sweat Lodges.

SITE #	LOCATION	DESCRIPTION
WS 10	T25N R10E SEC 1	Possibly associated with WS 6, a possible residence identified by interviewees as belonging to Clyde Peshlakai, but in too disturbed a condition for identification. The sweat lodge may also be associated with activities and camps associated with Black Falls Trading Post (see Black Falls sites category).
WS 373	T25N R9E SEC 13	Associated with Temporary camp WS 383.
WS 670	T25N R10E SEC 32	Associated with Residential Site WS 667 (see Anderson 1977, Site B).
WS 769	T26N R10E SEC 29	Associated with the long-term use of agricultural season residences in Section 29.
WS 822	T26N R10E SEC 29	Same as above.
WS 1031	T25N R10E SEC 7	Associated with the use of WS 1029/30.
WS 1229	T25N R10E SEC 18	Constructed during the occupancy of WS 1461 for a Life Way ceremony for a local resident, performed by a medicine man from Leupp.
WS 1766	T25N R10E SEC 5	Association with other sites unknown.
WS 1781	T25N R10E SEC 5	Association with other sites unknown.

Ranch was also in the sheep business at various times, employing Basque sheepherders. Dan Fernandez, a Basque employed by the Babbitts, was living at Heiser Spring and running sheep during the early 1930s (Sallie Brewer Harris, personal communication 1984). Aso Spring, south of the Monument boundaries, is named for Ramon Aso, who was the Basque manager of the Aso ranch. The ranch was located near the Babbitt's Cedar ranch, and is now abandoned (Preston Mercer, personal communication 1984).

All these occupants of the Monument can be assumed to have contributed to the historic archeological record to some extent, particularly in livestock-related remains. While most of the Navajo residential sites discussed above contain corrals and many contain water-control features such as check dams or small reservoirs, several isolated features were also recorded. Tables 6.5, 6.6, and 6.7 list the temporary camps, isolated livestock management facilities, and isolated water-control facilities respectively.

"Livestock management facilities" refers primarily to corrals or pens, but many are walls or fences blocking off portions of canyons. Local residents stated that canyons were often blocked off with walls to form sheep corrals or holding areas for horses during roundup, particularly in the Antelope Wash and Deadman's Wash areas. A section of Deadman's Wash was photographed in the 1930s during one such activity, when a horse corral was formed by stretching a rope across the canyon and draping large blankets over it (Sallie Brewer Harris photo collection, on file, Museum of Northern Arizona, Figure 6.23).

"Historic water-control facilities" also refers to isolated features such as check dams and rain catchment reservoirs. Water-control features present on residential sites and temporary camps (e.g., WS 1429, WS 2284, WS 1425, WS 1429, W LLC D G, and W LLC D F) were not listed again under this category, nor were livestock facilities on residential sites and temporary camps relisted under livestock management facilities. Figures 6.24 through 6.26 illustrate the geographic distributions of each site category.

Isolated Historic Dumps and Historic Petroglyphs

As for sites related to livestock raising, the presence of isolated trash dumps and historic petroglyphs cannot necessarily be attributed to Navajo occupation. For this reason, these site classes are considered independently of the Navajo occupation. Tables 6.7 and 6.8 list the isolated historic dumps and historic petroglyphs respectively; their geographic distributions are illustrated in Figures 6.27 and 6.28.

Sites Related to Black Falls Crossing

Black Falls has played a significant role as a crossing on the Little Colorado River throughout history. It was the crossing along the major Hopi trail from the Hopi villages to the San Fransico Peaks since at least the early nineteenth century (Colton 1964; Hartman and Wolf 1977:22). Black Falls was the western turning point for the 1851 exploratory expedition of Lieutenant Lorenzo Sitgreaves between Zuni and the Gulf of California via the Colorado River (Hartman and Wolf 1977:20). It was a stock-changing location and rest stop for Mormon pioneers along the Mormon Trail during the 1870s (Peterson 1973:84). By 1888, the first of a series of trading posts was established

TABLE 6.5. Locations and Descriptions of Temporary Campsites.

SITE #	LOCATION	DESCRIPTION
WS 60	T25N R8E SEC 10	Temporary camp including a corral, and probably associated with corral WS 57. May indicate temporary occupation during seasonal movement of sheep between Grey Mountain and the monument (see WS 1880 and WS 1908 below for elaboration).
WS 311	T25N R10E SEC 14	"Temporary Camp" designation problematic, but presence of ephemeral habitation and hearth remains suggest short-term use, possibly associated with the occupation of WS 306.
WS 330	T25N R9E SEC 13	Sheep camp, dates of use and owners unclear. Apparently last used c. late 1940s/early 1950s, possibly by the Smith family, but un-confirmed. Monument grazing files indicate that one resident reported a Navajo burial on or near this site, but no ethnohistorical information confirmed this.
WS 383	T25N R9E SEC 13	Sheep camp used by Peshlakai family from at least 1940s and possibly earlier. Used various seasons, and at least one winter during WWII. Use possibly terminated during 1960s, and then re-used for two years in the 1970s. Use of the camp by Navajo residents of the Monument was then apparently discouraged by NPS personnel, but its use was reconsidered in 1978 during grazing permit negotiations. NPS files indicate that the site was "cleaned up" by the NPS in about 1977.

TABLE 6.5. (continued)

SITE #	LOCATION	DESCRIPTION
WS 422	T25N R9E SEC 13	Winter sheep camp, initially used by Peshlakai Etsidi prior to the 1930s and possibly as early as 1900s/1910s. Intermittently used by others (e.g., Big Ben) and finally by Clyde Peshlakai and his family at least through 1940s.
WS 713	T25N R10E SEC 20	"Temporary Camp" designation problematic, but presence of small enclosure and ephemeral hearth indicated short duration of occupation.
WS 944 WS 947	T25N R9E SEC 17 T25N R9E SEC 18	Temporary occupation indicated by ephemeral remains of brush structures and charcoal from small fires. See notes for WS 1880 and 1908 for discussion of Navajo temporary camps in in this area post-1930s.
WS 1044	T25N R10E SEC 8	Again, temporary occupation indicated by hearth, ash dump, and possible tent pad. No corral present. Function unknown, but worked copper and brass present in assemblage.
WS 1429	T25N R10E SEC 2	Agricultural camp used by family of Clyde Peshladai until the early 1960s. Crops were planted during the years that precipitation allowed. Possibly associated with the corral at site WS 1425.
WS 1462	T25N R10E SEC 18	Sheep camp used by Clyde Peshlakai's daughter and her family during the summers from about the early 1960s until about 1970, when the access road was closed.

TABLE 6.5. (concluded)

SITE #	LOCATION	DESCRIPTION
WS 1793 WS 1795	T25N R10E SEC 5 T25N R10E SEC 5	Both sites categorized as temporary occupation due to the presence of hearths but lack of corrals or habitation structures. Trash indicates c. 1940s dates, consistent with the period of use of the upper basin north of Antelope Wash.
WS 1889 WS 1908	T25N R9E SEC 14 T25N R9E SEC 14	While Navajo livestock grazing activities have not regularly included the area east of the basin for several decades, temporary camps have been used until recently during the drive of sheep from Grey Mountain to the Monument each year. One such event is noted in the Wupatki files for August 1979, at which time the sheep and the herders were in the vicinity of Cedar Canyon west of the Citadel and were preparing to camp for the night. Overnight stays during herding may account for temporary camps east of the prairie, as may temporary camps established during wood cutting activities.

TABLE 6.6. Locations and Descriptions of Isolated Livestock Management Facilities.

SITE #	LOCATION	DESCRIPTION
WS 57	T25N R8E SEC 10	Small, isolated juniper brush corral, date unknown, but possibly related to seasonal movement of sheep from Grey Mountain to Wupatki each year. May be associated with temporary camp WS 60.
WS 304	T25N R10E SEC 15	Small sandstone enclosure built onto sandstone outcrop, probably associated with the occupation of WS 303.
WS 307	T25N R10E SEC 14	Small sandstone enclosure in Kana's Wash, probably associated with the use of WS 306 or the temporary occupation of WS 311. Small check dams cross listed with Water Control Facilities.
WS 740	T25N R10E SEC 20	Primary feature is a series of sandstone walls enclosing a section of a sandstone ledge in Deadman's Wash. In association are sections of barbed-wire fence and a "1956" petroglyph. At least one of the fences was built by Jerry Tunney to contain livestock in the canyon. (Site cross-listed with Historic Petroglyph site category.)
WS 875	T25N R9E SEC 17	Isolated brush corral, may be related to seasonal drive of sheep from Gray Mountain to Wupatki and may be associated with temporary camp at WS 944.
WS 963	T25N R9E SEC 18	Same as WS 875, and may be associated with temporary camp at WS 947.
WS 1015 WS 1016	T25N R103 SEC 12	Two related corral areas associated with sheep and cow manure, may be related to the use-area of the Grebb family, but use history unknown.

TABLE 6.6. (continued)

SITE #	LOCATION	DESCRIPTION
WS 1019	T25N R10E SEC 12	Two isolated corrals, separated by approximately 200 meters. Possibly related to the Grebb family use-area. A petroglyph of "Ned 1944" may indicate use by the Lee family (cross-listed with Historic Petroglyph category).
WS 1070	T25N R9E SEC 2	Series of small sandstone walls in Antelope Canyon, probably representing the period of use of the upper basin, prior to the 1940s.
WS 1073	T25N R9E SEC 2	Same as above.
WS 1425	T25N R10E SEC 2	Corral area, probably related to the use of temporary camp WS 1425.
WS 1483	T25N R10E SEC 19	Dismantled corral area, probably related to the occupation of WS 1526.
WS 1608	T25N R9E SEC 6	Brush corral, use history unknown.
WS 1788	T25N R10E SEC 5	Corral associated with the occupation of residential site WS 1783.
WS 1826	T25N R10E SEC 32	Series of sandstone walls blocking off a portion of a drainage to form a livestock containment area. Period of use unknown.
WS 1835 WS 1845	T25N R10E SEC 16	Segments of sandstone wall and barbed wire forming small enclosures along a sandstone ledge over Deadman's Wash, probably associated with the occupation of residential site WS 1836.

TABLE 6.6. (concluded)

SITE #	LOCATION	DESCRIPTION
WS 1925 WS 2045 WS 2049 WS 2051 WS 2066	T25N R9E SEC 11 T25N R9E SEC 14 T25N R9E SEC 11 T25N R9E SEC 11 T25N R9E SEC 11	Fence-line and sandstone wall segments blocking off portions of Antelope Wash Canyon to contain livestock in various sections of the canyon bottom.
WS 2114	T25N R8E SEC 1	Ephemeral indication of small isolated brush corral. Use history unknown, but possibly used during seasonal move of sheep between Grey Mountain and the Monument.
WS 2341	T25N R10E SEC 22	Sandstone corral, probably related to the occupation of WS 2300.
WS 2379	T25N R10E SEC 6	Possible segment of historic wall on otherwise prehistoric site.
WS 2424	T25N R10E SEC 6	Historic component of this site is a large sandstone corral incorporating natural geographic barriers. Probably associated with the pre-1940s occupation of the upper basin.
WS 2649	T25N R9E SEC 16	Isolated small brush corral, history unknown.
WS 2551	T25N R9E SEC 4	Two isolated wooden water troughs, cultural affiliation and dates of use unknown.

TABLE 6.7. Locations and Descriptions of Historic Water-Control Facilities.

SITE #	LOCATION	DESCRIPTION
WS 294	T25N R20E SEC 15	A natural rain catchment reservoir in a small sandstone rincon in Deadman's Wash that collected a deep pool of water. The feature is associated with an agricultural field area in the bottom of the wash, originally planted by Peshlakai Etsidi prior to the 1930s while using residential site WS 1848. Small check dams were used to control runoff in the field, which was not irrigated. The field was replanted in the 1950s by Jerry Tunney, and produced primarily watermelon and squash, in addition to corn. It was planted in April and harvested in August or September. An inscription of "Ned Lee" is cross-listed with Historic Petroglyphs.
WS 307	T25N R10E SEC 14	Check dams and suggestions of other ephemeral structures in Kana's Wash, probably associated with the use of the residence at WS 306 or the temporary occupation of WS 311. Cross-listed with Livestock Facilities.
WS 658	T25N R10E SEC 32	Sandstone wall forming a forming a possible water-control feature associated with Peshlakai Spring. Dates of construction and use unknown.
WS 728	T25N R10E SEC 21	Small sandstone check dam crossing unnamed wash north of Wukoki ruin.

TABLE 6.7. (continued)

SITE #	LOCATION	DESCRIPTION
WS 842 WS 843	T26 R10E SEC 29	Small water-collection areas formed by construction of sandstone walls along portions of wash to collect runoff. Associated with the long-term use of Section 29 during Agricultural seasons. Corn-storage room on WS 842 cross-listed with "Other" site category.
WS 1489	T25N R10E SEC 19	An apparent water-catchment area dug into the sandstone bedrock associated with an early hogan (see Residential Site category). Association of the apparent water-control feature and the hogan problematic, due to the early date of the hogan and the use of cement in the water-catchment device.
WS 1498	T25N R10E SEC 19	Location of the former Wupatki Spring Pump house, including sandstone walls and a water trough, in use between the 1930s and the 1960s.
WS 1725	T25N R20E SEC 5	A large, manmade water-catchment reservoir referred to as Ma'ii To' (Coyote Water) by Navajo residents. The reservoir served as a primary water source on the Monument. It was in use from at least the 1930s and probably earlier into the 1950s. The large reservoir filled up during the rainy season, sometimes to a depth of 10 feet, enough to last at least 3 months and sometimes throughout the winter. Large sandstone walls in the reservoir are now completely silted in, but it used to be continually cleaned out.

TABLE 6.7. (concluded)

SITE #	LOCATION	DESCRIPTION
WS 2304 WS 2305	T25N R10E SEC 22	Large rock reservoirs constructed by Clyde Peshlakai and referred to as Tsegi To' (Rock Water) in Navajo. The reservoirs were constructed subsequent to the construction of the hogan at WS 2303 and were used by the Peshlakais and other families. Construction dates of the reservoirs are unknown, but the reservoirs are still functional.

on the north or east side of the river at Black Falls.

A small post was constructed near the falls in 1888 and run for two years by Sam Preston, a trader with another store at Tuba City. The post was taken over by Fred Voltz from 1891 to 1893, and was closed permanently in 1893. In 1912, another small post was operated by Albert Biggs and D.K. Ward, but lasted only until 1914. One other post was established on the north side of the river by Jack and Glenn Taylor, and finally, in 1941, The Black Falls Trading Post was built on a section of State-owned land on the south (west) side of the river in the Wupatki basin by Emmet Kellam (Hartman and Wolf 1977:25, Figure 6.29).

The latter post served as a focal point for various activities in the Black Falls area from its opening in 1941 until its closing in 1964. The first and foremost of these activities (and the reason for the post's establishment) was the Black Falls Irrigation Project, an ill-fated project undertaken by the Indian Service to provide irrigation water to the local Navajos.

Entries to the Southwestern Monuments Monthly Narrative Reports (SMMNR) indicate the activities associated with the project, beginning with the drilling of the well in August 1940 and the planned construction of the diversion dam in time for the floods during the following spring. A camp was established on the north side of the river for the Navajos working on the project, and in April 1941, Emmett Kellam, a former Indian Service employee, began construction of the Black Falls Trading Post on the south side of the river to do business with the Navajos employed by the Irrigation Project. In November of the same year, Kellam purchased the Taylors' post on the north side of the river in order to determine which post would be the most successful. Unfor-

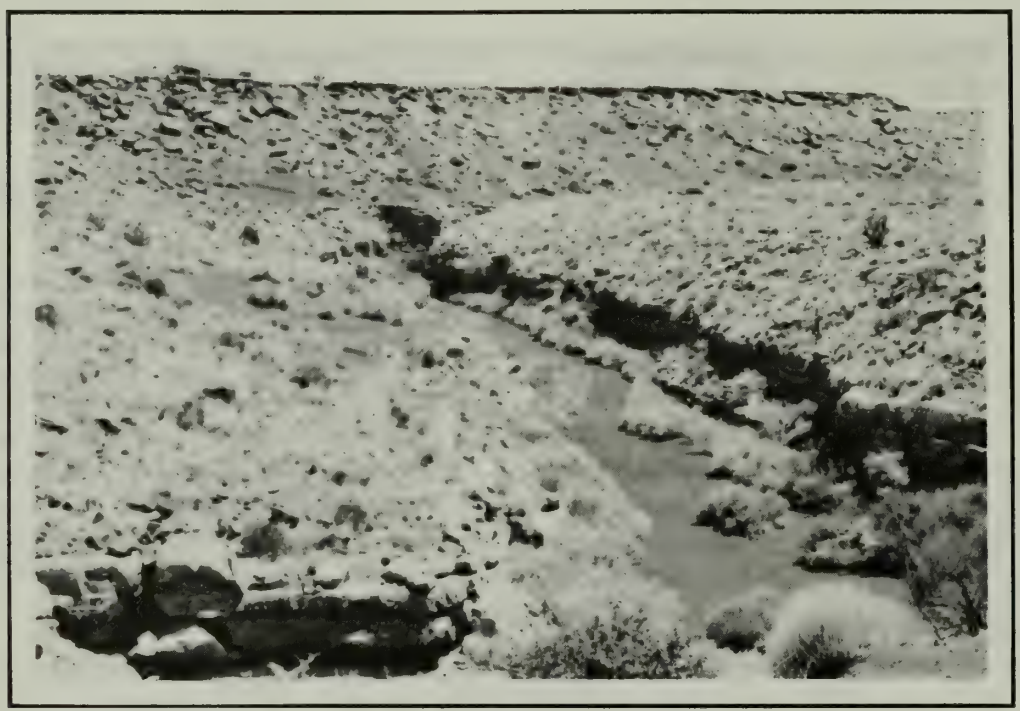


FIGURE 6.23. Deadman's Wash today (a), and in use as a horse corral, circa 1935 (b). Photo (a) by Alexa Roberts in 1985, and photo (b) by Sallie or Jim Brewer, courtesy of the Museum of Northern Arizona (MS242-2-26).

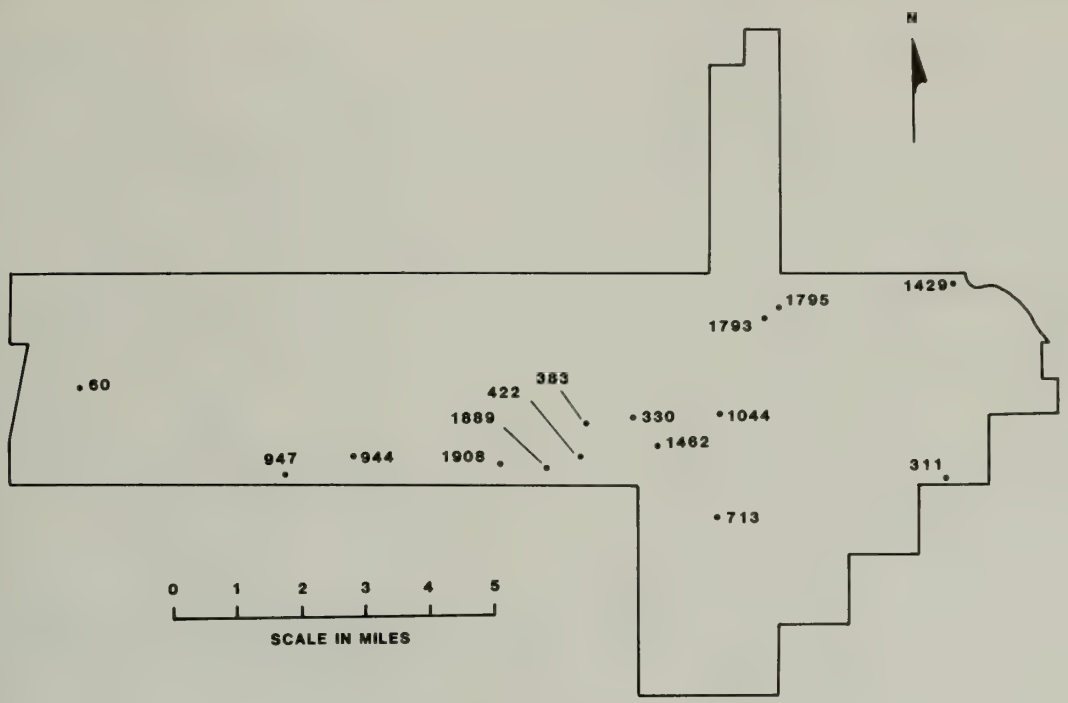


FIGURE 6.24. Geographic Distribution of Temporary Camps.

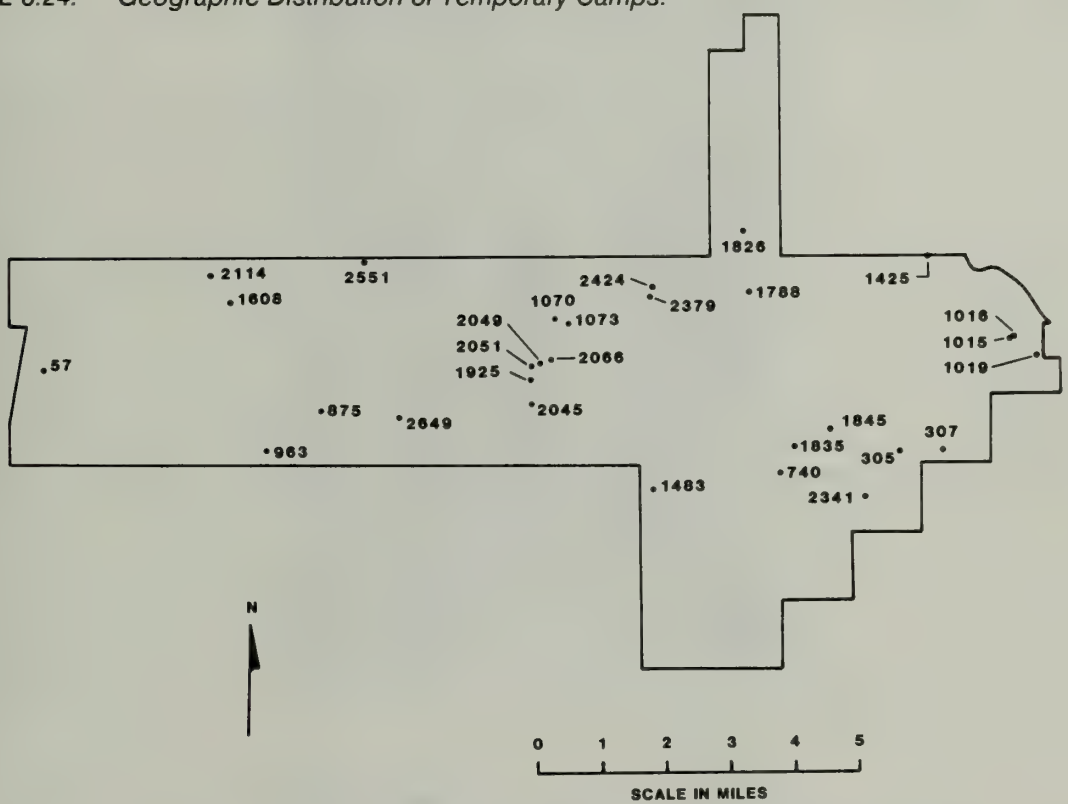


FIGURE 6.25. Geographic Distribution of Isolated Livestock Management Facilities.

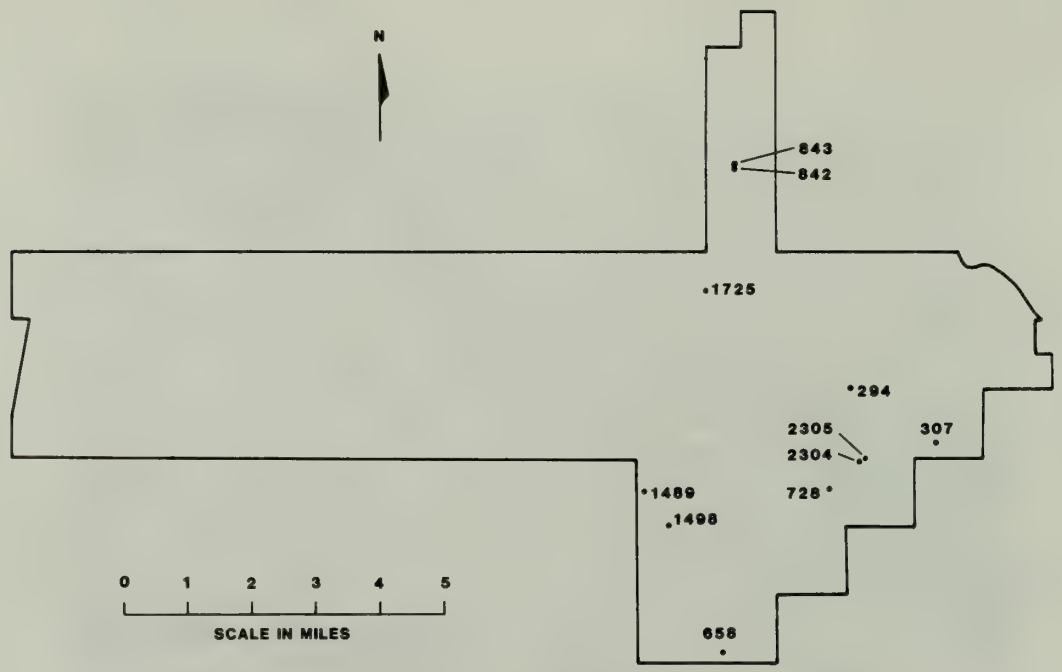


FIGURE 6.26. Geographic Distribution of Isolated Water-Control Facilities.

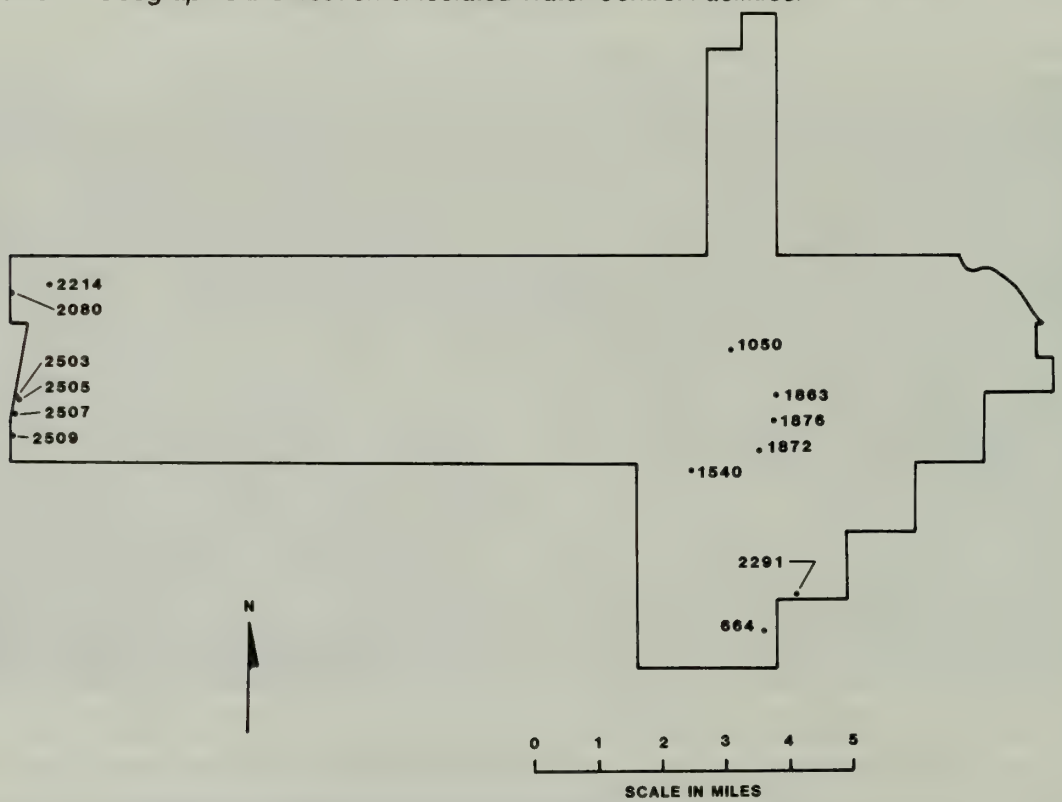


FIGURE 6.27. Geographic Distribution of Isolated Historic Dumps.

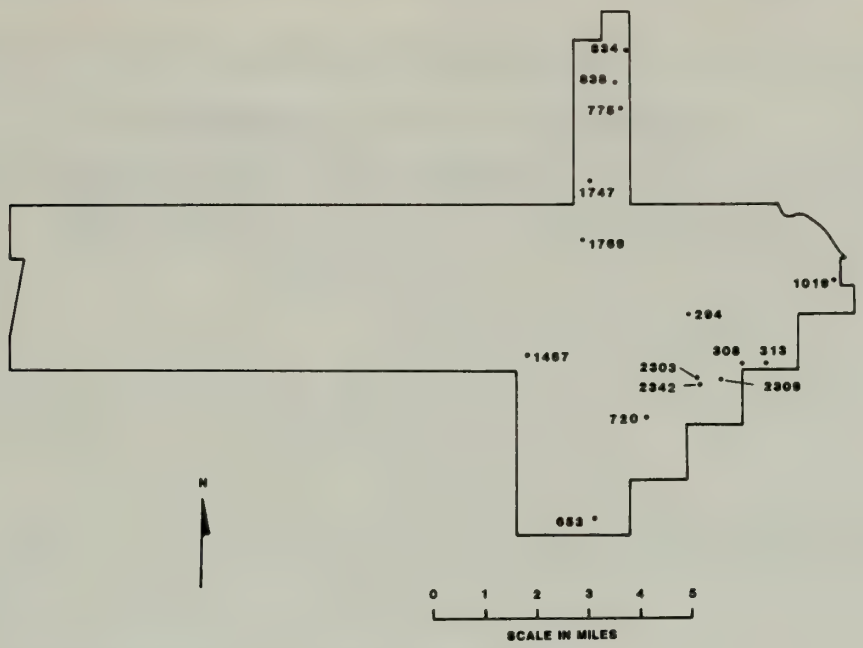


FIGURE 6.28. Geographic Distribution of Historic Petroglyphs.

FIGURE 6.29. Black Falls Trading Post circa late 1940's-early 1950's. Trader Emmett Kellam on right, and Katherine Peshlakai with children on left. Photo courtesy of Mrs. Helen Davis.

TABLE 6.8. Locations and Descriptions of Isolated Historic Dumps.

SITE #	LOCATION	DESCRIPTION
WS 664	T25N R10E SEC 32	Small, isolated post-1940s trash dump of unknown cultural affiliation.
WS 1050	T25N R10E SEC 8	Small, isolated dump containing animal bone, glass fragments, brass parts, a rifle cartridge, and sherds of a historic Hopi bowl.
WS 1540	T25N R10E SEC 29	Isolated dump containing domestic refuse and burned material. Possible association with occupation of WS 1526 affiliation problematic. Dump possibly created when WS 1526 was cleaned up by the N.P.S. to prepare for the burial and funeral of Clyde Peshlakai in 1970.
WS 1863 WS 1872 WS 1876	T25N R10E SEC 17	Post-1940s domestic refuse dumps, possibly associated with the occupation of WS 1836 and/or WS 1839.
WS 2080	T25N R8E SEC 3	Trash scatter containing food and beer cans, in addition to a portion of an Eastman Kodak movie-film canister, associated with Highway 89.
WS 2291	T25N R10E SEC 28	Circa 1960s domestic refuse, possibly associated with the late occupation of WS 2293.
WS 2214 WS 2503 WS 2505 WS 2507 WS 2509	T25N R8E SEC 3 T25N R8E SEC 15	Rock dumps related to the construction of Highway 89.

TABLE 6.9. Locations and Descriptions of Historic Petroglyphs.

SITE #	LOCATION	DESCRIPTION
WS 294	T25N R10E SEC 15	Inscriptions "n.1." and "Rex Lee" probably referring to the Lee brothers Ned and Rex. Associated with the agricultural field near Peshlakai Etsidi's residence (WS 1848) and cross-listed with water-control feature 294.
WS 308	T25N R10E SEC 14	Petroglyph panel containing a biplane, a man in a cowboy hat, the word ATEBO, and miscellaneous other figures. The panel is associated with cairn and a trail (cross-listed with "Other").
WS 313	T25N R10E SEC 14	Inscription "Indian Power" (in problematic association with miscellaneous sandstone slab features against the wall of a wash).
WS 653	T25N R10E SEC 32	Various historic rock-art panels along the mesa edge at Peshlakai Spring (associated with two sandstone cairns, cross-listed with "Other").
WS 720	T25N R10E SEC 21	Stick figure on horse, cross-listed with "Sites of Unknown Function."
WS 775	T25N R10E SEC 29	The name "BEN" written backwards and an upside-down "Y" with an "A" under it, associated with a small sandstone enclosure in a wash bottom.
WS 834 WS 838	T26N R10E SEC 20	Historic component of dozens of rock panels all along Horseshoe Mesa.
WS 1019	T25N R10E SEC 12	Inscription "Ned 1944" associated with isolated corral #1019, probably referring to Ned Lee.

TABLE 6.9. (concluded)

SITE #	LOCATION	DESCRIPTION
WS 1467	T25N R10E SEC 18	Two apparently historic petroglyphs of indeterminate form and origin, associated with prehistoric site.
WS 1747	T26N R10E SEC 32	Apparent historic component of prehistoric site containing indeterminate petrolgyph panels and ephemeral structures.
WS 1769	T25N R10E SEC 5	Historic rock-art component of prehistoric site consisting of horses, wagon-wheel-like figures, and what appears to be a 1950s model car.
WS 2303	T25N R10E SEC 22	Inscriptions "Navajo Juani--July--Juanita Brown" "July 15, 1955--July 4, 1961" & "U (Forest Service symbol) S" associated with residential site 2303.
WS 2309	T25N R10E SEC 22	Portrait of someone with hair in traditional yarn-wrapped bun, incised into rock.
WS 2342	T25N R10E SEC 22	Miscellaneous petroglyphs including three "E"'s and an "R" written backwards, a "5", and a circle with a line through it. Panels associated with a cairn and a raptor's perch containing guano, feathers, fur, and small bones (Cross-listed with "Other.")

tunately, neither post would capture the business of the Navajos employed by the Irrigation Project for long, as CCC funds expired and the project was abandoned in June 1942.

Kellam continued to operate the post on the south side of the river, however, establishing a successful trading business with the Wupatki Navajos that remained under his operation for the next eleven years. Emmett's uncle Joe, who had originally come to Arizona from Oklahoma, purchased the J Diamond Cattle Company from Jack Diamond, followed by his two brothers, Jess and Lee. Jess had three children, including a daughter and two sons, Emmett and Irving. Emmett had gone to work for the Indian Service before entering the trading business, and Joe, leaving the cattle business after World War II, owned the Monte Vista hotel in Flagstaff. Emmett also had an interest in the Tusayan Lodge at the Grand Canyon, having apparently loaned money for its construction (Preston Mercer, personal comunication 1984).

During the Kellams' tenure at the Black Falls Trading Post, the post served as one of the primary locations for local Navajo trading activity (see Euler 1949 for an economic analysis). The Kellams were reported to be good, fair traders (Katherine Peshlakai, personal communication 1985), and spoke fluent Navajo (Hartman and Wolf 1977:25). In August 1943 a state land transfer including T25N R10E Section 1 resulted in the trading post's becoming part of the Monument, and the center of various activities. As reported by various superintendants in the Southwestern Monuments Monthly Narrative Reports, for example:

> July 25, 1943--a very quiet Fourth was enjoyed at Wupatki. The Navaho contingent of the population went "en masse" to the festivities in Flagstaff.... Their return looked like the rebirth of the pioneer days, for a train of ten wagons put up for the night of the sixth at Black Falls.

> October 1945--Spent the day of October 26 at Black Falls, attending the Indian Service branding of horses, mules, burros, and cattle.

> December 27, 1947--A Christmas Party for the Navajos was held at Black Falls Trading Post. This was well attended by more than 150 Navajos from this general vicinity.... Primary sponsors were the Kellams of the Black Falls Trading Post, Mrs. A.F. Brandeis of Flagstaff, and Mr. and Mrs. R.J. Flemming of Santa Barbara, California.... NPS personnel assisted on their own time. A most successful and pleasant time was experienced by all.

> August 20, 1951--... sheep count at Black Falls...

> December 23, 1953--Trader Herb Huckreedy played host to the local Navajo families at a Christmas party held at the Black Falls Trading Post....

> January 1955 or 56--... the annual sheep count was held...

> December 1956--On two different occasions Wupatki personnel helped play host for Christmas parties held for local Navajo families. On December 15 about 200 Navajo attended a party given for them at the Black Falls Trading Post by the Flagstaff Mission to the Navajo and on December 16 the families living on the Monument attended a party given to them by the Sternberger Drilling Comapny of Cameron.

> May 1964--The Grey Owl Productions Company has worked intemittantly in the vicinity of Black Falls Trading Post in the filming of a Walt Disney Production "Coyote Come Home"...

TABLE 6.10. Sites Associated with Black Falls Crossing.

SITE #	LOCATION	DESCRIPTION
WS 4	T25N R10E SEC 1	Scattered trash and possible lumber structural elements just south of the trading-post site.
WS 5	T25N R10E SEC 1	Hearths and scattered trash close to Black Falls Crossing.
WS 6	T25N R10E SEC 1	Heavily disturbed area, possibly representing the remains of a former residence of the Peshlakais, just south of Black Falls Trading Post.
WS 7	T25N R10E SEC 1	The site upon which Black Falls Trading Post stood from 1941 to 1968.
WS 9	T25N R10E SEC 1	Possible old trading-post foundation, with trash dates indicating turn-of-the-century occupation. The single-course basalt foundation suggests a wood-frame superstructure which was subsequently removed. The foundation is located on the southern bank of the Little colorado, on a basalt outcrop in a tamarisk thicket. The only documented post in the Black Falls area in operation during the period represented by the artifacts on WS 9 is that of Albert Biggs, from 1912 to 1914. Although Biggs' post is reported to have been located on the north-east side of the river, the sparse amount of trash, the artifact dates, and the ephemeral nature of the structure support the possibility of an early post in this location.
WS 18	T25N R10E SEC 1	Three small basalt walls incorporated into a basalt outcrop and boulders, with associated trash, near Black Falls Crossing.
WS 19	T25N R10E SEC 1	Possible sweathouse foundation, but function problematic.

TABLE 6.10. (concluded)

SITE #	LOCATION	DESCRIPTION
WS 20	T25N R10E SEC 1	Small basalt structure on riverbank north of Crossing, function unknown.
WS 22	T25N R10E SEC 1	Tent pegs and scattered trash suggest camp area, although no hearths noted.

By 1964, the post had seen its fifth trader come and go since the Kellams' departure. The operation of the post became a source of endless problems for both the NPS and the Navajos by the early 1960s for a variety of reasons, and by 1964, it was abandoned. In 1968, the post was bulldozed by the NPS, leaving no trace of its 23-year operation. The events surrounding Black Falls Crossing form an interesting history in and of themselves, and one which should eventually be compiled. In the meantime, the sites listed in Table 6.10 and Figure 6.30 leave some evidence of the variety of roles the crossing has served since about the turn of the century.

Historic Sites of Unknown Function

The majority of historic sites of unknown function consist of miscellaneous small, isolated rock structures and features. In most cases they were determined by the field crews to be historic on the basis of a combination of factors, including one or more of the following: presence of historic artifacts, lack of prehistoric artifacts, locations in wash bottoms, dry laid masonry, and/or presence of cut juniper. The functions of isolated rock enclosures of various kinds is problematic. Occasionally, small pens are constructed to contain lambs that may be born while a herd is grazing, but such incidences should not be common enough to account for the numbe of structures located on the Monument. A former resident of the Grey Mountain area recalled that "In many places along the canyon walls, beneath strata of limestone, there are natural caves large enough so that small [storage] rooms can be prepared underneath the overhanging rocks" (Dinetsosie 1977:77). Most of the isolated features, however, are too ephemeral and distant from residential sites to be storage rooms. Furthermore, as discussed earlier, it need not be assumed that all historic structures are the result of Navajo occupation. The functions of these sites may never be known, but they add an

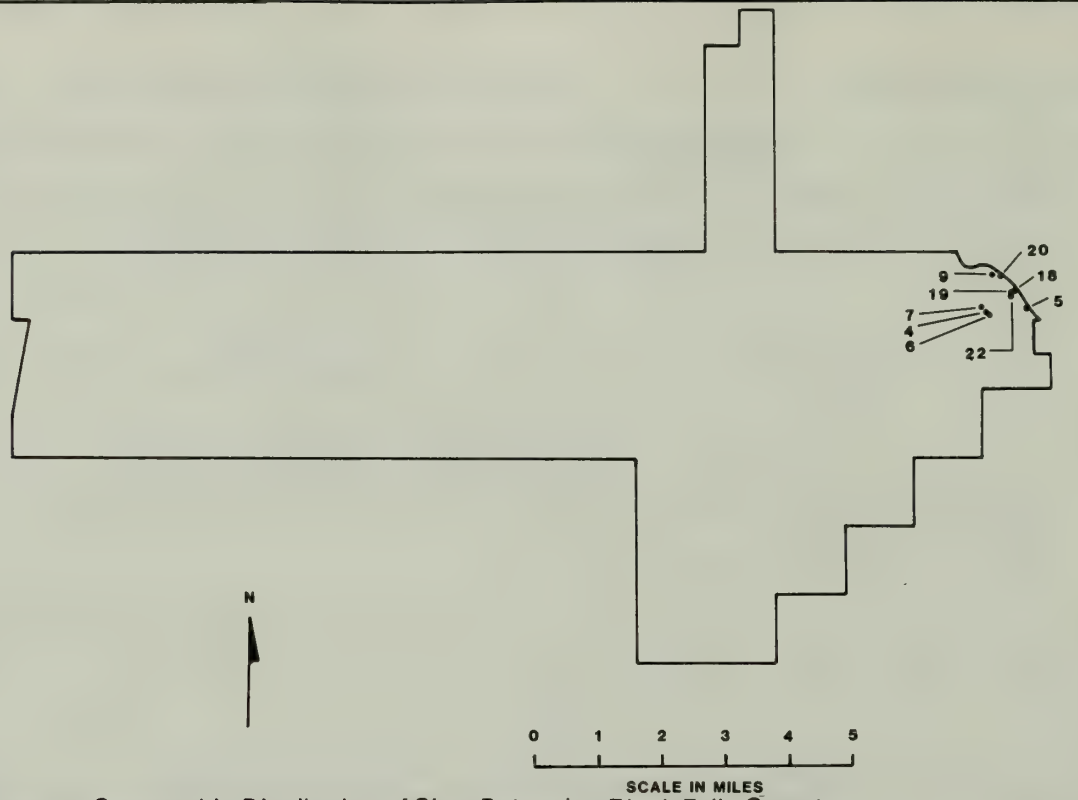


FIGURE 6.30. Geographic Distribution of Sites Related to Black Falls Crossing.

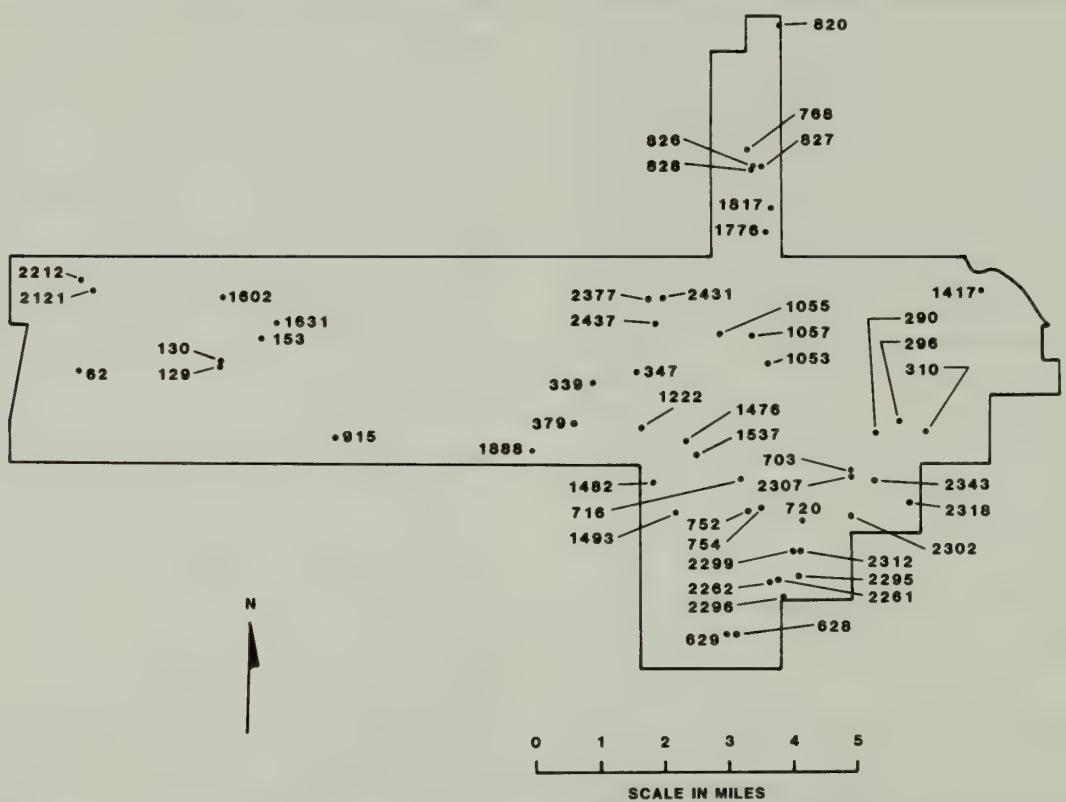


FIGURE 6.31. Geographic Distribution of Historic Sites of Unknown Function.

additional dimension to the historic cultural landscape of the Monument. The historic sites of unknown function are listed in Table 6.11; their distributions are illustrated in Figure 6.31.

TABLE 6.11. Sites of Unknown Function.

SITE #	LOCATION	DESCRIPTION
WS 62	T25N R8E SEC 8	Unidentifible Limestone enclosure with historic trash and charcoal.
WS 129 WS 130	T25N R9E SEC 7 & 12	Four depressions and scattered trash, possibly a tent campsite, but lack of hearths makes function problematic.
WS 153	T25N R9E SEC 7	Scattered historic and prehistoric artifacts associated with small rock structures of unknown function.
WS 290	T25N R10E SEC 15	Scattered historic trash associated with cut juniper branches over a dirt mound.
WS 296	T25N R10E SEC 15	Ephemeral ring of pine logs.
WS 310	T25N R10E SEC 14	3m X 3m alignment of sandstone slabs with scattered historic trash.
WS 339	T25N R9E SEC 12	Small limestone enclosure in bottom of wash with charcoal associated.
WS 347	T25N R9E SEC 12	Two small sandstone structures, only associated artifact is a metal gas can.
WS 379	T25N R9E SEC 13	Small basalt and limestone rectangular structure in wash bottom, with juniper branches set into the walls.
WS 628	T25N R10E SEC 32	Small U-shaped sandstone structure near wash with scattered trash.

TABLE 6.11. (continued)

SITE #	LOCATION	DESCRIPTION
WS 629	T25N R10E SEC 32	Several small, ephemeral sandstone features near Heiser Spring.
WS 703	T25N R10E SEC 21	Cleared area on small ridge top, with a hearth and scattered trash.
WS 716	T25N R10E SEC 20	5m X 7m sandstone foundation with scattered milled wood and trash.
WS 720	T25N R10E SEC 21	Small upright sandstone slab box with scattered bottle glass. Petroglyph of stick figure on a horse 170m. SW.
WS 754	T25N R10E SEC 20	Small sandstone enclosure constructed underneath sandstone overhang with small sandstone walls and misc. trash.
WS 752	T25N R10E SEC 20	Miscellaneous prehistoric and historic small sandstone structures under overhang in tributary of Deadman's Wash.
WS 768	T26N R10E SEC 29	Small sub-rectangular structure against sandstone outcrop. Leather strap and horseshoe associated.
WS 820	T26N R10E SEC 17	Small square sandstone slab foundation with a wood-chopping area.
WS 826	T26 R10E SEC 29	Three ephemeral sandstone structures at base of sandstone outcrop with scattered trash in association.
WS 827	T26N R10E SEC 29	Small C-shaped sandstone enclosure with low limestone wall across opening.
WS 828	T26N R10E SEC 29	Two small sandstone slab structural foundations.

TABLE 6.11. (continued)

SITE #	LOCATION	DESCRIPTION
WS 915	T25N R9E SEC 17	Approximately 15 juniper structural elements, including 2 forked sticks.
WS 1053	T25N R10E SEC 8	Basalt cobble structure built into sandstone embankment of wash with sparse scattered historic trash.
WS 1055	T25N R10E SEC 8	Sandstone enclosure built into side of wash.
WS 1057	T25N R10E SEC 8	Small ring of upright slabs with scattered juniper and cottonwood limbs.
WS 1222	T25N R10E SEC 18	Basalt rock piles and limestone blocks with historic trash around a borrow pit used as a water source.
WS 1417	T25N R10E SEC 2	Depression in a cobble surface flanked by two rows of rocks arranged in pairs, an opening toward a slab feature.
WS 1476	T25N R10E SEC 18	The only artifact representing an historic component on this prehistoric site is a wood lath with a nail in it.
WS 1482	T25N R10E SEC 19	An alignment of basalt, sandstone, and limestone rocks with milled lumber, with historic and prehistoric trash.
WS 1493	T25N R10E SEC 19	Sandstone enclosure under sandstone overhang with pile of juniper branches.
WS 1537	T25N R10E SEC 18	Historic component of prehistoric site consists of axe-cut juniper branches and a figure of a horse and rider cut from a piece of metal.
WS 1602	T25N R9E SEC 6	Scattered historic trash and a portion of a historic road on an otherwise prehistoric site.

TABLE 6.11. (continued)

SITE #	LOCATION	DESCRIPTION
WS 1631	T25N R9E SEC 6	Historic and prehistoric artifacts and scattered juniper branches associated with a rock pile of unknown origin.
WS 1776	T26N R10E SEC 32	A series of ephemeral sandstone structural remains and historic trash scattered among several low ridges and washes over an area of 250m X 100m.
WS 1817	T26N R10E SEC 32	Small historic stacked sandstone slab feature on a prehistoric site.
WS 1888	T25N R9E SEC 14	A small depression with limestone rocks and a dead juniper tree in the center with scattered trash associated.
WS 2121	T25N R8E SEC 2	Historic trash associated with prehistoric petroglyphs in an alcove in a basalt outcrop near the north blowhole.
WS 2212	T25N R8E SEC 3	Rock enclosure constructed against an outcrop, containing a buried can covered with a basalt rock.
WS 2261	T25N R8E SEC 29	Small rock enclosure in the bottom of a tributary to Heiser Wash, associated with a small 1950s trash dump.
WS 2262	T25N R10E SEC 29	Small collapsed sandstone structure against an outcrop with bottle glass.
WS 2295 WS 2296	T25N R10E SEC 28	Sandstone enclosure against an outcrop, in addition to various wall segments and miscellaneous trash.
WS 2299	T25N R10E SEC 28	Ash mound with sandstone slabs and scattered trash.
WS 2302	T25N R10E SEC 22	Scatter of historic trash on site of indeterminate function.

TABLE 6.11.(concluded)

SITE #	LOCATION	DESCRIPTION
WS 2307	T25N R10E SEC 22	Isolated hearth and single can.
WS 2312	T25N R10E SEC 28	Scattered historic trash with problematic structural remains.
WS 2318	T25N R10E SEC 22	Historic component consists of possible modification of prehistoric site.
WS 2343	T25N R10E SEC 22	Isolated sandstone walls associated with historic trash.
WS 2377	T25N R10E SEC 6	Possible historic modification of prehistoric site.
WS 2431	T25N R10E SEC 6	Upright sandstone-slab feature, with milled lumber, axe-cut juniper, and scattered trash.
WS 2437	T25N R10E SEC 6	Small historic structure of indeterminate function with a piece of modified tin.

Miscellaneous Other Historic Sites

Finally, the sites listed in Table 6.12 are miscellaneous "other" historic sites of known functions but which did not fit into the remaining site categories and Figure 6.32 illustrates all historic sites at the Monument. Their descriptions are self-explanatory.

TABLE 6.12. Locations and Descriptions of Miscellaneous Other Historic Sites.

SITE #	LOCATION	DESCRIPTION
WS 308	T25N R10E SEC 14	Sandstone cairns and a portion of a trail, associated with historic rock art (cross-listed with petroglyphs).
WS 309	T25N R10E SEC 14	Historic sandstone quarry.
WS 368 WS 403	T25N R9E SEC 13	Isolated axe-cut juniper.
WS 653	T25N R10E SEC 32	Historic stacked sandstone cairn, cross-listed with petroglyphs.
WS 842	T26N R10E SEC 29	A semi-subterranean storage room with a log roof, partially filled with corncobs. Associated with the agricultural sites in the section, and cross-listed with isolated water-control facilities.
WS 1412	T25N R10E SEC 30	The site of the 1936 Navajo Craftsman Exhibition (see text for discussion). Originally containing a large forked-stick hogan, four ramadas, and a sweathouse, the site now consists only of a hogan ring and ash pile, the rock discard pile from the sweathouse, and scattered areas of sandstone alignments and fire-reddened sandstone slabs. The hogan was occupied as a residence subsequent to the show until about 1956, and is cross-listed with Residences.
WS 1505	T25N R10E SEC 18	A "Victor" double-spring coyote trap, probably dating between the 1920s and 1930s, on a prehistoric site. Trappers were camped at Heiser Spring during the 1930s (Brewer n.d.).

TABLE 6.12. (concluded)

SITE #	LOCATION	DESCRIPTION
WS 1812	T25N R103 SEC 11	Isolated stacked sandstone cairn with single axe-cut cottonwood log.
WS 1918	T25N R9E SEC 14	Religious features on Doney Mountain; refer to Management Recommendations for discussion.
WS 2356	T25N R10E SEC 6	Section of historic trail.
WS 2275	T25N R10E SEC 28	A small walled-in rock shelter, presumably for storage. Cross-listed with hogan 2275, but association uncertain.

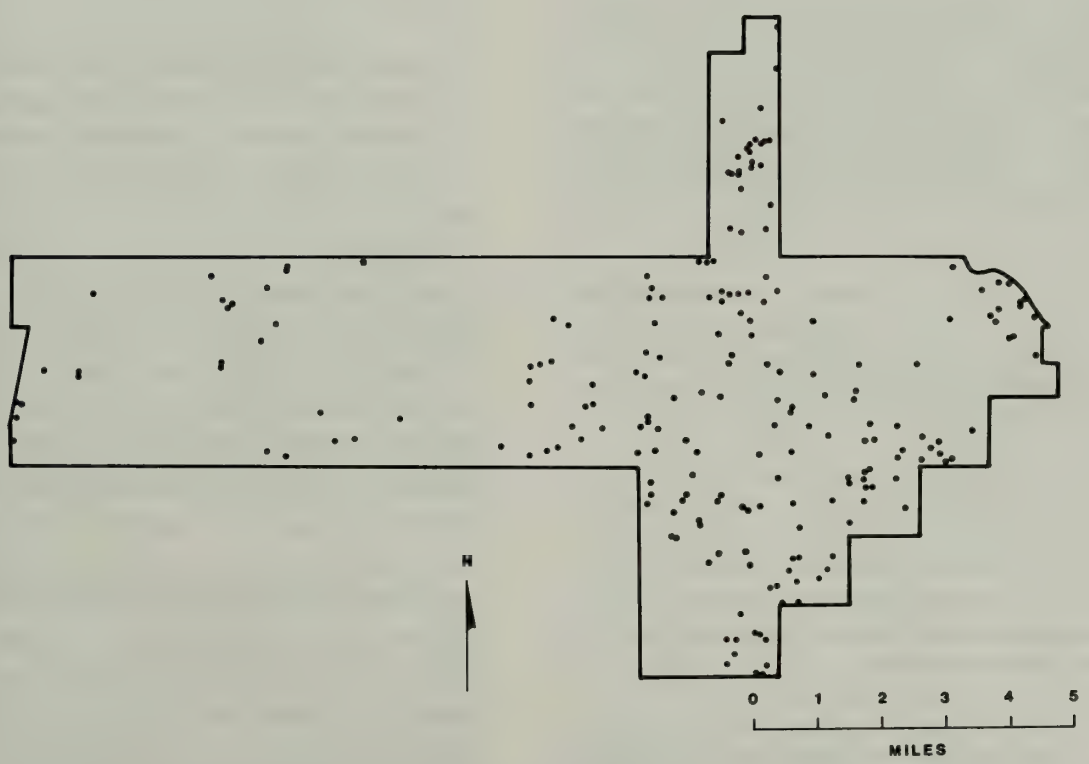


FIGURE 6.32. Wupatki National Monument, All Historic Sites.

RECOMMENDATIONS FOR MANAGEMENT AND FUTURE RESEARCH

This section presents a brief evaluation of the ethnohistoric study vis-a-vis the initial goals envisioned by the NPS, followed by recommendations for management in accordance with NPS mandates.

Assessment of Goals

As discussed earlier in the Administrative Background, the implementation of an Ethnohistoric Research Project had been identified as a need for Wupatki in numerous planning documents over a period of several years. The final Study Package Proposal (Package No. 137, 1982) described the project as a study of ". . . Navajo cultural, religious, and economic relationships within the greater Wupatki-Sunset Crater area. The study will integrate anthropological, historical and archeological data." Ten specific goals were identified for the study:

> 1. Navajo geography, described through time and in detail, including sites, place names, uses, use areas, resources used, seasonal patterns of use, settlement patterns, and other subsistence activities.
>
> 2. Kinship relations.
>
> 3. Political organization such as chapter organization and major events of the Tuba City and Leupp Agencies.
>
> 4. Inter-socio-political structure, including relationships among families, clans, chapters, and agencies as well as interaction with early whites . . .
>
> 5. Economic patterns through time, history of allotments and the allotting program, impact of development of Wupatki on economic activities, and other economic data.
>
> 6. Oral history collected, translated, and described if possible.
>
> 7. Documentary research such as BIA, agency, and NPS records.
>
> 8. Site-specific information such as sacred places and shrines, subsistence and use areas, burials, old trading posts, and other unique sites . . .
>
> 9. Ethnohistorical data to complement archeological survey, occupation of sites, utilization of area, etc.
>
> 10. Broad patterns for contextual framework such as how American Indian Policy specifically affected Wupatki Navajos and other historic patterns in economic and political development of the Navajos.

These goals have been met, particularly with regard to numbers 1, 2, 5, 6, 7, 8, and 9 and to a lesser degree numbers 3, 4, and 10. As a word of caution, however, it is necessary to reiterate here the need for advance planning and budgeting. The Ethnohistoric Research Project emphasized the collection of ethnographic data through a program of interviewing, yet the costs of a vehicle and reimbursement for Navajo consultants were not initially budgeted for. Funds for a vehicle were allocated for the second field season, but funds for reimbursement to interviewees had to be obtained through a grant from the Southwest Parks and Monuments Association. Funds also were not available for investigation of documents

housed in the National Archives, a source essential to complete historical analysis.

For future ethnohistoric studies, such as collection of Hopi oral history, adequate funds must be identified early in the planning process and included in any project budget. Furthermore, the write-up and reporting of future ethnohistoric studies must be considered part of the budgeted project and not put out for bid on a subsequent contractual basis, since it would be virtually impossible for an individual other than the ethnohistorian to write up the results of such a study in an adequate and meaningful manner.

Compliance with the Federal Mandates

The Study Package Proposal justifications for the implementation of the ethnohistoric study are to satisfy NPS's mandates under the National Historic Preservation Act (NHPA) and the American Indian Religious Freedom Act (AIRFA) and to assist in protection of religious and significant sites and in park planning, interpretation, management decisions, and policy development. The following discussion outlines the mandates established by NHPA, AIRFA, and the NPS Final Native American Relationships Policy (September 22, 1987) and provides management recommendations for compliance with each of them.

National Historic Preservation Act

The National Park Service is responsible for the protection of its cultural resources under various federal mandates, including the NHPA. Section 110 of the NHPA establishes that each federal agency is responsible for the preservation of cultural properties and will implement programs to locate, inventory, and nominate all properties eligible for inclusion to the National Register of Historic Places (NRHP). Agencies are further directed to plan any undertakings so as to minimize harm to any NRHP eligible properties and to insure that properties will not be inadvertently transferred, sold, demolished, altered, or allowed to deteriorate. Under Section 106 of NHPA, each agency is directed to take into account the effect on NRHP properties of any undertaking of the agency. The Advisory Council on Historic Preservation must also be afforded the opportunity to comment on these effects.

In accordance with Section 110(a)(2), the historic cultural resources of Wupatki have been located. They have not yet been individually evaluated for their NRHP eligibility, nor have they been nominated. The Navajo cultural resources at Wupatki will be most effectively evaluated, nominated, and managed as a Rural Historic District as outlined for the NPS in Cultural Landscapes: Rural Historic Districts in the National Park System (Melnick 1984).

A rural historic landscape district is defined as

> ". . .a geographically definable area, possessing a significant concentration, linkage, or continuity of landscape components which are united by human use and past events or esthetically by plan or physical development." Rural hist ric districts are further explained as. . .extensive land areas where the composition of physical elements by a culture group or groups was influenced by the natural characteristics of the location itself. It was achieved, however, in a way which reflects the distinctiveness of the culture group(s) and their particular activities over the period of historical development. . . . Landscape components are tangible evidence of certain activities and habits characteristic of the culture group(s) responsible for their construction and development, and inevitably reflect

non-material aspects of these groups (Melnick 1984:8).

The Navajo cultural resources of Wupatki satisfy this definition. The Navajo rural historic landscape retains its integrity and is considered potentially eligible for the NRHP as defined in 36 CFR 60.4, criteria c and d. Melnick (1984) should be used to formally identify, evaluate, nominate, and manage a rural historic landscape district at Wupatki. These tasks may be most easily accomplished by an individual or individuals on a contract basis.

Miscellaneous documents in the Monument files indicate that historic sites have, at various times in the past, been "cleaned up" by the NPS. In accordance with NHPA Section 106, the NPS must first evaluate the NRHP eligibility of any cultural resource to be affected by an undertaking. If it is determined eligible, the ACHP must be provided the opportunity to comment on the potential affects pursuant to 36 CFR Part 800. The NPS, therefore, must recognize that the historic archeological sites at Wupatki are protected by federal legislation and may not be modified in any way until their NRHP eligibility is determined in consultation with the Arizona State Historic Preservation Office and, as necessary, the ACHP consulted, or until a management plan for a rural historic district has been accepted by the ACHP.

American Indian Religious Freedom Act

The American Indian Religious Freedom Act is a re-affirmation of the First Amendment rights of Native Americans. The act establishes that it is the policy of the United States to protect and preserve American Indians' inherent rights of freedom to exercise traditional religious practices. AIRFA directs federal agencies to consult with Native American religious leaders in order to evaluate the effects of agencies' policies and procedures on Native American access to sacred sites, use and possession of sacred objects, and freedom to worship through traditional ceremonies.

The NPS Native American Relationships Policy (III)(A) recognizes the NPS's responsibility under AIRFA and outlines directives for park superintendents regarding Native American Access and Use (III)(B), Taking of Natural Resources (III)(C), and Traditional Sacred Resources (III)(D) (including burial and cemetery sites).

The Navajo Nation Draft Proposed Policy to Protect Navajo Sacred Places, defines a sacred place as:

> a location that has traditionally been considered important to an Indian tribe, or member thereof, because of a religious event which happened there, because it played a part in life-cycle rituals of individuals, because it contains specific natural products which are of cultural or religious importance, because it figures in or is mentioned in myths and sacred songs, because it is considered the dwelling place or embodiment of spiritual beings, because it is conducive to communication with spiritual beings, or because it has other specific and continuing significance in Indian religion or culture. Such places may be considered important only to smaller segments of Indian populations such as chapters, clans, families or individuals.

In a recent analysis of the meaning of land to Navajos faced with removal and relocation from their traditional homes within the Hopi Partition Lands, sacred places are discussed on two levels (Cahn 1982). The first of these consists of places sacred to all Navajos or substantial numbers of traditional Navajos regardless of where

they live. The second level contains places sacred to users of a customary use-area, including individuals, families, or extended family groups. The authors point out that in terms of daily life, the highly visible places sacred to the entire Navajo population may not be nearly as important as the local places of religious significance to the individual, family, or clan. Furthermore, these localized places cannot be considered independent of the land itself, just as daily activities cannot be considered independently of spiritual life.

Cahn's (1982) study illustrates the levels of religious significance with a series of maps of a portion of a customary use-area that encompasses approximately twelve square miles. The first map at the individual, family, or clan level depicts the sacred areas surrounding a hogan. The hogan itself is the most personal and central sacred place to a Navajo, as it is blessed prior to occupation and subsequently used for both domestic and ceremonial purposes. Surrounding the hogan are additional places of potential religious significance, including:

*ceremonial hogans;

* sweat lodges;

* the places where unbilical cords are buried;

* trees from which parts of a cradleboard were cut;

* trees sanctified for a ceremony;

* trees from which pieces of a ceremonial bow were cut;

* natural springs used in protection ceremonies;

* trees struck by lightning;

* places where eagles nest;

* places where individuals have died in solitude;

* rock piles through which the wind speaks;

* rock formations which echo back prayer;

* hogans in which individuals have died of old age;

* places of individual meaning associated with ceremonies;

* places associated with the puberty rites of young women;

* Anasazi ruins where prayer figurines have been placed in association with curing ceremonies.

In addition to these specific family religious sites, the study identified 29 sacred places (e.g., gathering places of plants and other natural materials) associated with the Blessingway ceremony and 30 sacred places associated with the conduct of 24 other ceremonies. Finally, the places of religious significance to all Navajos include:

* places mentioned in particular blessings or ceremonies or in the Creation story;

* places associated with the history, actions, or residences of the Holy People;

* places containing the restorative power of particular rare plants, sands, or minerals which are collected by healers for ceremonial use throughout Navajoland.

The compilation of all of these places on a single map, marking each sacred place with a black symbol, resulted in a map literally black with the symbols of sacred places. It was not possible to identify sacred places at Wupatki at such a fine-grained level. To do so would require a study designed solely for the purpose, and its success would be dependent on locating the individuals able and willing to describe the landscape in these terms. A study of such depth could only be successfully completed by a Navajo researcher.

While the entire landscape at Wupatki must be considered to contain religious significance for portions of the Navajo population, some specific places have been identified as requiring special protection under AIRFA. All sites containing hogans, as well as all sweat lodges, may be blessed and are therefore AIRFA protectable.

Several burial locations have also been identified. Specifically, sites WS1024, WS2300, WS1815, WS1526, and an unnumbered site in Section 13 on the southern Monument boundary line contain burials. All of these sites must be strictly avoided. The site on the southern Monument boundary line, while not technically the NPS's responsibility, should be fenced by the NPS and protected. A burial may also be located in the vicinity of site WS1829. The burial of an infant is eroding out of a crevice on a hillside in Section 14 in the southeast corner of the Monument and should be protected from further erosion. Four or five other burials have been described in unmarked locations throughout the Monument, and more are likely to exist. While the unmarked burials cannot be specifically identified for protection, it is recommended that if any additional burials are located and are in danger of exposure or disturbance, the Navajo Nation should be contacted and the Navajo Nation Burial Policy should be implemented for disposition of the remains.

While plant-gathering areas were mentioned by several individuals, none were specifically identified. Similarly, various Anasazi ruins may have been used ceremonially in the past, and it is possible that curing or prayer figurines may be discovered on some of them during the course of future archeological or stabilization work. Disturbance of such figurines may release power with potentially detrimental consequences to an individual or individuals. Should the discovery of a figurine on a ruin ever occur, it must be left in place and handled only be a medicine man. The religious significance of the ruins in Hopi oral tradition must also be considered under NPS's AIRFA responsibilities.

While no Enemy Way or other major ceremonial sites were discovered during the archeological survey, several "Squaw Dances" (Enemy Way ceremonies) were reportedly held on the Monument during the 1940s (see Monthly Narrative Reports). All of these sites were reported to have been "cleaned up" subsequent to their use. Many smaller and more personal ceremonies have been (and continue to be) held in residential and special ceremonial hogans throughout the Navajo occupational history of the Monument. Ceremonies are said still to be held occasionally at the "blow hole" near the eastern Monument entrance. While the superintendent should be notified in advance of ceremonies that are to be held in loca-

tions other than private residences on the Monument, the participants should not be required to obtain permits to conduct religious observances. Reasonable stipulations regarding removal of trash or temporary structures or restricting the use of fires, may be imposed, but the ceremonial must otherwise be unrestricted. Park visitors must also be restricted from access to the location of an ongoing ceremony if so requested by the participants.

In addition to these local-level sacred places, several major places of religious significance to all Navajo people have been identified in the Wupatki vicinity by various researchers. Of primary concern among these places are Doney Mountain and Sunset Crater. Both of these are among the many cinder cones in the area that are said to be the homes of some of the Holy People. One story from the Leupp area relates that after the Holy People taught the Navajo people the proper way to live and the proper ceremonies, they left them to fend for themselves and made their homes in the natural formations of the earth. Among the chosen homes were the cinder cones below the San Francisco Peaks, which is one of the four major sacred mountains defining Dinetah (the homeland given to the Navajos by the Holy People), and itself a home to the Holy People. As Holy Peoples' homes, the cinder cones were used as models by the Navajos for the hogans in which they live (Navajo Nation Historic Preservation Department n.d.).

Doney Mountain (Dzil Lichii or Red Mountain) has also been described (Van-Valkenburgh 1941:51; Watson 1964:22) as a sacred eagle nesting area. The apparent presence of a series of shrines at site WS1918 below the crest of the mountain reinforces Doney Mountain's religious significance. Similarly, Sunset Crater (Navajo: Dzil bilatah litso [Yellow Topped Mountain]; Hopi: Polotsmo [Red Hill] or Kana'as Katchinik [Home of the Kana'as Kachinas]) has been identified by Van Valkenburgh (1941:153-154) as a sacred place to both Navajos and Hopis. It is mentioned in the Navajo Creation Story as a stopping place of the Western Water Clan, as is Black Point (Tsezhin deez'a'hi), four miles downstream from Wupatki on the Little Colorado River.

Black Point is also the site of a significant Hopi shrine located along one of the principal historic Hopi trails which led from Hotevilla to Supai. Another major Hopi trail led from Oraibi west along the Dinnebito Wash, crossing the Little Colorado River (possibly at Black Falls), going through the Wupatki basin past Heiser Spring to Sunset Crater, and ending at the San Francisco Peaks, a primary Hopi sacred place (Colton 1964; Van Valkenburgh 1941).

While the places discussed here do not constitute all of the Navajo sacred places in the Wupatki vicinity, they are significant places which must be treated in accordance with the mandates established by AIRFA and the NPS Native American Relationships Policy. Further directives under the policy are discussed in the following section.

Native American Relationships Policy

The Native American Relationships Policy is designed to ensure that the NPS fulfills its responsibility towards Native American groups with demonstrable ancestral ties to resources within units of the National Park System. The completion of the ethnohistory project at Wupatki demonstrates ancestral Navajo ties to resources within the Monument. Wupatki must therefore be considered one of the National Park System units

> "specifically charged with the mission to preserve and interpret the cultural heritage of Native American tribes or groups. In addition, many units contain natural resources as well as features of the built environment, objects and structures that are associated with traditional sacred, subsistence or other cultural practices of contemporary Native American peoples and necessary for their cultural continuity. Service plans, programs and activities all have the potential to affect such places and resources and the cultural activities associated with them" (Section I, A).

The history of the Wupatki Navajos has shown that the Monument contains natural resources and features of the built environment associated with traditional sacred and subsistence practices. NPS Park Service plans, programs, and activities have in the past affected Navajo cultural continuity of the Navajos remaining on the Monument. Specific provisions for Native American use of and access to traditional subsistence and sacred resources within park boundaries are provided in Section III of the Policy. With these provisions and directives in mind, recommendations have been made for addressing traditional sacred resources in the context of the Navajo Special Use Permit at Wupatki.

The Special Use Permit issued to the descendants of the last Navajo male "head of household" in 1980 recognized the association between Park resources and Navajo traditional cultural practices. As the permit comes up for renewal in 1990, however, it should be re-evaluated to insure that NPS plans, programs, and activities do not adversely affect Navajo cultural continuity.

Several specific points should be addressed in re-negotiating the next Special Use Permit. Item #1 of the permit provides a legal description of the designated Navajo use-area within the Monument. In addition to this legal description, the authorized use-area should also be described in language easily interpreted by the permitees. A verbal description, using Navajo names as necessary, should be included. This may be most easily accomplished by touring the authorized use-area with the permitees and recording the Navajo terms used to describe the area that corresponds with the legal descriptions.

The wording in item #2 states that Navajo use of their traditional lands is a privilege granted to them by the NPS, and one that will be supervised by the Monument superintendent. This wording should be deleted. This section should maintain the condition that Navajo use of the Monument must comply with regulations governing the area, and copies of these regulations should be made available to the permitees.

Items #3 and #4 specify limits on the number of animal units to be grazed in accordance with range analyses and limits on the permissible buildings and structures to be used by the permitees. At the time of the permit renewal, both the range capacity and the currently used structures should be re-inventoried and adjusted as appropriate. If the new permit is to be issued on a ten-year basis, provisions should be included for periodic re-assessment of animal units, range capacity, and structures and facilities during that time. Copies of range analysis reports must be made available to the permitees.

In keeping with the mandates established in the policy regarding interference with Native American cultural continuity, the second half of the sentence in item #9, which specifies termination of the permit upon the death of the current permitees, must be deleted. Since descendants of the current permitees should not be removed from the Monument upon the current permitees' deaths, livestock officially transferred to the descendants should be allowed

to be grazed on the Monument so long as they do not exceed the numbers permissible according to range analyses.

Item #10 states that the NPS reserves the right to cancel the permit if Navajo use of the Monument ". . . becomes detrimental to the purposes for which Wupatki National Monument was established." This legislated purpose should be explicitly stated, as should the actions that would be considered detrimental to this purpose.

Item #11 in the final permit was changed from drafts which stated that the permit would be revocable if the permitees violated any of its conditions. The final permit, on advice from the Southwest Regional Field Solicitor (May 17, 1975), reads, ". . . revocable at any time at the discretion of the Superintendent." This wording permits an arbitrary decision, one made by an individual which could detrimentally affect the lives of an entire family. The wording in this section should revert to that included in drafts of the permit, as it currently appears to violate the policy.

Finally, item #12 provides for renewal of the permit at ten-year intervals by mutual agreement of the parties. This section should include a process by means of which the permitees could appeal a decision made by the NPS if the parties cannot reach an agreement.

The new permit should be approved by regional- or national-level NPS officials and by officials of the Navajo Nation. It should be explained to the permitees and signed in the presence of Navajo Nation officials, including an interpreter. Consultation with the appropriate Navajo Nation officials should be carried out under the provisions of Section IV of the policy.

Section IV, part A of the policy directs superintendents to maintain a current roster of the appropriate consultants for the Native American groups affected by park operations. The representatives of the groups will then be consulted regarding ". . . planning, management, and operations decisions that affect the subsistence and sacred materials or places, or other ethnographic resources with which the group is historically associated."

The Navajo Nation should be consulted formally through the Office of the Chairman. Correspondence will then be routed to the appropriate Division or Department, which may include the Department of Justice, the Tribal Parks Department, or the Navajo Nation Historic Preservation Department, depending on the subject. Each of these departments may also be contacted individually. All offices may be contacted through the Nation's central address at P.O. Box 308, Window Rock, Arizona, 86515. Consultation regarding museum collections should also be carried out with the director of the Ned A. Hatatli Museum, Navajo Community College, Tsaile, Arizona, 86556. The councilmen and/or chapter officials of the Cameron and Leupp chapters should also be consulted in matters regarding specific former residents of the Monument.

Sufficient time must be allocated in matters requiring consultation with the Navajo Nation to allow the circulation of correspondence through the appropriate Tribal offices. An initial meeting between NPS and Tribal officials should be scheduled at the earliest opportunity to discuss future planning, rather than waiting for individual matters to arise. Advance planning will be particularly important with regard to interpretation of the Native American heritage of the park, which is

mandated in Section V of the policy. Section V part C states that:

> The Service shall actively seek Native American consultation in the planning, development, and operation of park interpretive programs that relate to the culture and history of the particular tribe or group, shall develop cooperative programs with tribes and groups to assist the Service in the interpretation of their cultural heritage in parks, and shall provide for presentation of Native American perspectives of their own lifeways and resources, both cultural and natural.

The information gathered by the ethnohistory project provides the basis for updating the interpretive programs to reflect Wupatki's Navajo heritage--a significant portion of the Monument's history that has long been incidental to the interpretation of prehistoric cultures. New displays and messages should be geared toward an understanding of and pride in Wupatki's Navajo history, land use, and archeology. Visitors should be afforded the opportunity to experience the Navajo contribution to the Monument's cultural landscape, as well as that of the Anasazi and Sinagua. This experience may be provided by two means.

First, in keeping with NHPA Section 110 and 36 CFR Part 800 mandates, the Monument should undertake a program of stabilization of Navajo habitation sites, so that visitors using the backcountry will not adversely affect the sites, nor will the NPS adversely affect them by allowing them to deteriorate. Those sites suitable for stabilization may be identified during preparation of the Rural Historic District nomination. Stabilization in the context of such a nomination will satisfy NPS's Section 106 responsibilities, after appropriate consultation. If the Rural Historic District nomination option is not selected, each site identified for stabilization must undergo a Section 106 evaluation prior to stabilization. Sites containing burials must be avoided, and consultation with the Navajo Nation should begin early to ensure that there are no objections by former occupants of the sites to a stabilization program.

Stabilization of a Navajo site for visitor access would be of interpretive value. Several factors, however, must be taken into consideration. First, almost all Navajo sites are in inaccessible locations, and monitoring of visitor activities on such sites may be difficult. In addition, the sites contain religious value, and allowing visitor access to them while the former inhabitants have been excluded from using them for the last 20 or 30 years would represent considerable insensitivity on the part of the NPS. Second, the preferred alternative to stabilization of an existing site for visitation is (re)construction of a site especially for that purpose. Wupatki is fortunate in possessing the location, the construction plans, and the historical documentation of a site that was intended expressly for visitation. The 1936 Ceremonial Show hogan and other features were originally constructed specifically for visitors. The location is easily accessible and easily patrolled. The construction plans and documentation of the step-by-step construction process were detailed in Jim Brewer's diary, the original of which is on file at Wupatki. Numerous photographs and even a movie of the show are on file at MNA. The NPS should develop a collaborative program with the MNA to reconstruct the Ceremonial Show hogan and to use the MNA photos and film in interpretive displays in the Visitors' Center.

Such a program would have many positive benefits. First, the site would be constructed specifically for visitation. No Section 106 consultation would be necessary and no former Navajo occupants of the

Monument would be offended. Second, the historical documentation is all at hand to provide a completely interpreted display and visitor experience at an actual site. Third, the Ceremonial Show represented one of the most positive eras of relations between the NPS and the Wupatki Navajos. Fourth, participants in the original show are still available for consultation (e.g., Miss Katherine Bartlett at MNA, Mrs. Sallie Brewer Harris, Mrs. Sallie Peshlakai Lee, and others). Fifth, members of the Navajo community could be invited to help in the construction and interpretation of the site, greatly strengthening NPS/Navajo Nation relations. Sixth, a joint effort between MNA and the NPS in recreating the site could coincide with one of MNA's annual Navajo Craftsmen Exhibitions, of which the 1936 Ceremonial Show was the first. The MNA show could commemorate the first 1936 show at Wupatki, and the films could be used at both MNA and the Monument. Visitors to the MNA Craftsmen Exhibition would undoubtedly be steered toward Wupatki, and vice versa.

Not only would such a project go a long way toward improving relations between the NPS and the Wupatki Navajos that have been severely strained in the past; it would provide the basis for a "ready-made" interpretive program that would be supported by the NPS and MNA, and would fulfill the NPS's various federally mandated responsibilities. Perhaps even more significantly, however, it would acknowledge to the Navajo community that the NPS recognizes the Navajo contribution to what is now a National Monument, and it would provide visitors with a memorable educational experience. As stated by Jim Brewer in 1936, "I think 100% of the visitors to Wupatki who have been escorted to a Navajo camp have written back expressing thanks. And in many cases they have declared this unexpected side trip one of the highlights of their entire trip" (Southwestern Monuments Monthly Narrative Report, June 1936).

Future Research

While the goals of the Navajo Ethnohistory Project as envisioned by the NPS have been met, the research raised new questions which must be addressed in future studies for a thorough understanding of the Monument's intricate and interesting history.

1. It is essential that a study of the significance of Wupatki to the Hopi people be undertaken in order to further identify and evaluate the nature of sacred places on the Monument, and in order to complete the Monument's Native American history. Since Wupatki and Sunset Crater are known to be places of religious and historical significance to the Hopi, the Hopi Tribal Government must also be consulted in matters of park program planning.

2. A history of the Black Falls Trading Post, from its establishment in 1941 to its destruction in 1968, should be completed. The study should concentrate on the relationship of the post to other trading operations along the Little Colorado River (cf., Babbitt 1986; Richardson 1986; Steckel 1987), the relationship of the post to the NPS, and its role in local economics, picking up where Euler's 1949 economic study left off.

3. An administrative history of the Monument, similar to the Administrative History of Canyon de Chelly (Brugge and Wilson 1976) should be prepared, detailing the long and complex series of land exchanges that resulted in the current Monument

size and structure, including acquisition of land and cultural resources from the railroad and the exchange of land for grazing privileges with the Babbitt cattle ranching operations.

4. Ongoing research in and around the Monument includes (1) ethnoarcheological investigations of changes in Navajo residential site structure as Navajo geographic mobility decreased over time (Roberts n.d.), and (2) a historic preservation study within the Leupp Chapter to identify and nominate to the National Register of Historic Places those cultural resources deemed significant by the community (Navajo Nation Historic Preservation Department n.d.). The results of these studies, when available, should be incorporated as appropriate into future planning of Navajo cultural resources protection and interpretation.

Conclusion

The history of the Wupatki Navajos over the last 120 years has been one of fluctuating relationships with a dominant and enveloping Anglo culture. Through it all, the Navajos have managed to retain a small corner of their traditional use-area in the Wupatki Basin, five generations after its initial settlement. By grazing a small herd of sheep and cultivating a field at a residence used by members of the family since the early 1930s, they have also maintained the basic structure of a subsistence-settlement system that has endured for over a century. With the completion of the Wupatki Ethnohistoric Research Project, the NPS has taken significant steps towards recognizing the continuity of the Monument's Navajo heritage. By implementing the recommendations made here, the NPS will also ensure that it has not allowed this Navajo heritage to come to an untimely end.

TABLE 6.13. Partial Genealogy of the Wupatki Navajos.

The following genealogy is based on information collected from a number of sources, including Mr. Philip VanCleve (personal files), Dr. Robert Euler (1949), Ms. Amy Weldon (1979), Mrs. Sallie Brewer Harris (personal files), and all of the people interviewed during the Wupatki Ethnohistorical Research Project. Special thanks go to Elsie Tohannie and her family who corrected numerous errors in an earlier version. The names used are real, as requested by the individuals who related the details of their family histories. Many dates of birth and death are unknown, and some clan relationships are unknown. While all available information for occupants of the Monument was included, there are undoubtedly many errors, omissions, and oversights, all of which are solely the fault of the ethnohistorian.

Many relatives of the first-generation settlers are either unknown or not included. For example, relatives of Beeshligai Etsidi (9) are known to live in the Leupp area but their exact relationships are unclear and their historical use of the Monument is problematic. Similarly, while the names of affines of direct descendents were included if known, genealogical data for the affinial families were not included. While some excellent

TABLE 6.13. (continued)

information exists (particularly that collected by Sallie Brewer Harris) for the in-laws of members of the current genealogy, these must be presented in the future as separate genealogies. The current genealogy represents strictly the direct descendents of the original family to settle in the Wupatki Basin.

Ten clans are represented in the Wupatki genealogy:

Tl'izilani (Many Goats)
Todich'ii'nii (Bitter Water)
Tsenjikini (Rebuilding of Rock Houses)
Tabaahi (Edge of Water)
Tachii'nii (Red Streak)
Tl'aashchi'i (Red Bottom Creek)
Tsinaajini (Dark Streak of Wood)
Kiyaa'aanii (Standing House)
Naakaii dine'e (Mexican People)
Kinlichii'nii (Red House)

Tlizilani, Tsenjikini, Tl'aashchi'i, and Naakaii dine'e were reported by one individual to be the traditional clans of the Wupatki area, while Todich'ii'nii, Tabaahi, and Kiyaa'aanii were said to be the traditional clans of the Grey Mountain area. One interviewee indicated that the Naakaii dine'e clan was the predominant clan south of Wupatki towards Grand Falls and Leupp.

The genealogy is divided into several sub-groups, as follows:

Group A: This group contains the original settlers of the original settlers of the Wupatki Basin (Generation I) and two generations of their descendants. Two generations prior to Generation I are included, but they lived between Grey Mountain and Black Point, and had not yet settled in the basin. Generation I indicates the initial occupation of the Wupatki Basin.

Group B: These are the families descended from Beeshligai Etsidi (9) and his wife's (10) daughter, I'dii Baa (12), by a previous marriage (11). B1 and B2 are the families descended from each son of the marriage of Beeshligai Etsidi and I'dii Baa.

Group C: The C group (C1 through C5) contains the families descended from Beeshligai Etsidi's (9) elder wife's (10) children from her previous marriage to Yalt'i'i (11). The descendants of these children (13-15) married and moved with the children of the other groups, occupying the Wupatki Basin.

Group D: These are the families (D1-D5) of the children of Beeshligai Etsidi (9) and his elder wife, Da'dii Baa (10).

TABLE 6.13. (continued)

Symbols used in the charts are:

△ -- male
○ -- female
= -- marriage
— -- sibling
| -- descendant

Roman numerals indicate generations and Arabic numerals correspond to the list of names following the charts (following York 1983). Maternal clan and dates of birth or death, if known, are indicated next to each name. A ----after the name indicates that the individual was known to be living as of 1985. A ? - ? indicates that the date of birth and/or death is unknown. A single ? indicates that whether or not the individual is living is unknown.

(Note: Due to corrections made after the original version of the geneology, some numbers in the numerical ordering of names have been added or deleted. Since the charts were drafted prior to some corrections, the final version was not renumbered into strict numercial sequence.)

A

Name	Clan	Birth/Death
1. Hastiin Bilii Ligaii	Tachii'nii	? - ?
2. Bilii Ligaii Bi'asdzaan	Naakaii dine'e	? - ?
3. unknown	unknown	d. before 1868
4. unknown	Tsenjikini	d. before 1868
5. Baaishnii Baa	Naakaii dine'e	? - ?
6. Daagha zhin	Tabaahi	? - ?
7. Asdzaan ligaii	Tsenjikini	? - ?
8. Chili	Tabaahi	b. circa 1800
9. Beeshligai Etsidi	Naakaii dine'e	1850 - 1939
10. Da'dii Baa	Tsenjikini	1847 - 1947
11. Yalt'i'i	unknown	? - ?
12. I'dii'Baa	Tsenjikini	? - ?
13. unknown	"	? - ?
14. unknown	"	? - ?
15. Pine Tree Woman	"	? - ?
16. Asdzaan Tseyaa	"	? - ?
17. Nikin baa	"	? - ?
18. Wife of Salt Man's Son (may be the same person as #16)	"	? - ?
19. Mark Anthony (Cal Smith)	"	? - ?
20. Clyde Peshlakai	"	1883 - 1970
21. Emmett Lee	"	? - ?
22. Hal Smith		? - 1958

TABLE 6.13. (continued)

	B1		
23.	Hal Biasdzaan	Tabaahi	? - ?
24.	Canyon Diablo Woman	unknown	? - ?
25-28.	unknown children	unknown	?
	B2		
29.	unknown	Tabaahi	? - ?
30.	Elizabeth Lee	unknown	? - 1945
31.	Sallie P. Lee	Tl'izilani	? - ----
32.	Charly Atcitty	Tsinaajinii	? - ?
33.	Mark Keam	Tabaahi	? - ?
34.	Madge Lee Keam	Tl'aashchi'i	c. 1920 - ----
35.	Peter Lee	Tabaahi	? - 1940
36.	Susi Lee	Tabaahi	1926 - 1984
37.	Jerry Tunny	unknown	1931 - ----
38.	Jimmy Lee	"	1931 - ----
39.	Eva Lee	"	?
40.	Mary Atcitty Lee (?)	"	"
41.	Jimmy Atcitty Lee (?)	"	"
42.	Sharon	Tl'aaschi'i	"
43.	Roseann	"	"
44.	Ernest	"	"
45.	Modesta	"	"
46.	Mark	"	"
47.	Rex Lee	"	"
48.	Ned Lee	"	? - 1968
49.	Elanor	"	1953 - ----
50.	Louise	"	1955 - ----
51.	Lorraine	"	1958 - ----
52.	Bobby	"	1959 - ----
53.	Ray	"	1960 - ----
54.	Lee	"	1962 - ----
55.	Jean	"	1963 - ----
56.	James	"	1963 - ----
57.	Virginia	"	1964 - ----
58.	Leo	"	1966 - ----
59.	Dianna	unknown	? - ----
60.	Ella Mase	"	"
61.	Harry	"	"
62.	Ella Mae	"	"
63.	Marie Ann	"	"
64.	Mary Jean	"	"
65.	Leland	Tl'aashchi'i	? - ----
66.	Shanna	"	"
67.	Shawn	"	"
68.	Leann	"	"
69.	Sara	"	"
70.	Gary	"	"
71.	Michelle	"	"
72.	Valencia	"	"
73.	Casius	"	"

TABLE 6.13. (continued)

74.	Emmerson	"	"
75.	Emory	"	"
76.	Jones	"	"
77.	Belinda	"	"
78.	George	"	"
79.	Leland	"	"
80.	Lyle	unknown	"
82-89.	unknown	unknown	?
	C1		
90.	John Beck	Naakai dine'e	? - ?
91.	Charly Begay	unknown	? - ?
92.	Mountain Chant Singer	Tabaahi	? - ?
93-95.	unknown	Tsenjikini	? - ?
96.	Alma Boone	"	1908 - ----
97.	Lucy Grebb	"	1903 - ----
	C2		
98.	Dan McClellan	"	? - ?
99.	Big Ben	"	c. 1900 - ----
100.	Manychildren	"	?
101.	Julia	unknown	?
102.	Andrew	"	? - ----
103.	Gary	"	"
104.	Gilbert	"	"
105.	Ernie	"	"
106.	Anna	"	"
107.	Gloria	"	"
108.	Carl	"	"
	C3		
109.	Mary Lou	"	? - ?
110.	Asdzaan Nez Ben	"	? - ?
111.	Anna Jean	Tsinaajinii	? - ----
112.	Sallie Ann	"	"
113.	Lucille Rex	"	"
114.	Ben Cody	"	"
115.	Sarah Tsosie	"	"
116.	Ellen Curley	"	"
117.	Leroy Dixey	"	"
118.	Jenny McCabe	"	"
119.	Sara Cody	unknown	"
120.	Elrina Cody	"	"
121.	unknown	"	"
122.	unknown	"	"
123.	unknown	"	"
124.	Laura Cody	"	"
125.	Elsie "	"	"
126.	Denise "	"	"
127.	Leroy "	"	"

TABLE 6.13. (continued)

128. Evelyn	"	"	"
129. MaryLou	"	"	"
130. Viva	"	"	"
131. Phillip	"	"	"
132. Lena	"	"	"
133. Devert	"	"	"
134. Ellen	"	"	"
135. Linda	"	"	"
136. Anita	"	"	"
137. May	"	"	"
138. Ben Jr.	"	"	"
139. Wayne	"	"	"
140. Perrie Tsosie		Tsinaajinii	"
141. Lillie	"	"	"
142. Pete	"	"	"
143. Jean Cody		"	"
144. Solomon Tsosie		"	"
145. Sandra Curtis		"	"
146. Michael Dixon		unknown	"
147. Mark	"	"	"
148. Evangeline McCabe		Tsinaajinii	"
149. Matilda		"	"
150. Dennis		"	"
151. Anderson		"	"
152. Mary Lou		"	"
153. Emerson		"	"
154. Tilden		"	"
155. Earlene		"	"
156. Jefferson		"	"
157. Sherrie		"	"
158. Treva		"	"
159. Eli		"	"
160. Patricia		"	"
161. Jerilyn		"	"
162. Petrina		"	"
163. Cheryl		"	"
164. Valdis		"	"
165. Valentina		"	"

C4

166. John Boone		Tabaahi	1902 - 1966
167. unknown		Tsenjikini	?
168. Dan		"	1940 - ----
169. unknown		"	?
170. Roy		"	1937 - ----
171. Rose		Tlizilani	?
172. Yazhe		Tsenjikini	?
173. Jack		"	1935 - ----
174. Jean		Todich'ii'nii	?
175. Pete (Pat)		Tsenjikini	1933 - ----

TABLE 6.13. (continued)

176.	Mary Begay (sister of 182)	Todich'ii'nii	?
177.	unknown	unknown	?
178.	Amos	Tsenjikini	? - ?
179.	Hugo	"	1929 - ----
180.	Louise Singer	Kiyaa'aanii	? - ----
181.	Mary Etta Boone	Tsenjikini	1926 - ----
182.	Harry Chee	Todich'ii'nii	? - ----
183.	Angie	Tl'izilani	? - ----
184-187.	unknown	Todich'ii'nii	?
188.	"	"	? - ----
189.	Allen	"	"
190.	unknown	"	"
191.	Arlene	"	"
192.	Arkie	unknown	"
193-195.	unknown	Kiyaa'aanii	"
196.	Jerry Chee	Tsenjikini	1964 - ----
197.	unknown	Todich'ii'nii	? - ----

C5

198.	Nez K'a'i Yazhi	Kiyaa'aanii	? - 1960
199.	unknown	Tabaahi	? - ?
200.	unknown	"	"
201.	Lady Edgewater	"	"
202.	unknown	unknown	"
203.	Mark Keam	Tabaahi	"
204.	Jack Grebb	Tsenjikini	? - ----
205.	Shirley Dayzie	Kiyaa'aanii	"
206.	Alvin Grebb	Tsenjikini	1922 - 1945
207.	Joe Grebb	"	? - 1950
208.	Lenora Paddock	unknown	? - ----
209.	Ruth	Tsenjikini	1926 - ----
210.	John McCabe	Todich'ii'nii	? - ----
211.	Olin	Tsenjikini	? - ----
212.	Faye	"	1928 - ----
213.	Ben Willie	Tl'izilani	? - ?
214.	Elsie Tohannie	Tsenjikini	1936 - ----
215.	Danny Tohannie	Tl'aashchi'i	? - ?
216.	Donna	Tsenjikini	? - ----
217.	John Daw	Todich'ii'nii	? - ----
218.	Helen	Tsenjikini	1919 - ----
219.	Andrew	Naakaii dine' e	1906 - ----
220.	Sheila	Kiyaa'aanii	? - ----
221.	Jack Jr.	"	"
222.	Marvin	"	"
223.	Jackie	"	"
224.	Douglas	"	"
225-6.	unknown	unknown	? - ?
227.	Irma	Tsenjikini	? - ----
228.	Patrick	"	"
229.	Thomas	"	"
230.	Robert	"	"

TABLE 6.13. (continued)

231.	Laura	"	"	
232.	Johnathan	"	"	
233.	Ruby	"	"	
234.	Rose	"	"	
235.	Bruce	"	?	
236.	Julia	Tachii'nii	? -	----
237.	Ronald	Tsenjikini	1955 -	----
238.	Cecilia	"	1956 -	----
238a	Etta	"	? -	----
239.	Larry	"	1957 -	----
240.	Rolinda	Naakaii dine'e	? -	----
241.	Nena	"	1959 -	----
242.	unknown	"	?	
243.	Eileen	Tsenjikini	1961 -	----
244.	unknown	unknown	?	
245.	Donald	Tsenjikini	1966 -	----
246.	Loretta	"	? -	----
247.	Anita	"	"	
248.	John	"	"	
249.	Francis	"	"	
250.	Kenneth	"	"	
251.	Nettie	"	"	
252.	James	"	"	
253.	Nelson	"	"	
254.	Harrison	"	"	
255.	Vela	"	"	
256.	Kathy	"	"	
257.	Anna	"	"	
258.	Ellis	"	"	
259.	Andrew	"	"	
260.	Benson	"	"	
261.	Ellen	"	"	
262.	Samual	"	? -	?
262a	Louise	"	"	
263.	Eldon	Tachii'nii	? -	----
264.	Philemina	"	"	
265.	Glena	"	"	
266.	Brenda	"	"	
267.	William	"	"	
268.	Byron	"	"	
269.	Lynette	Naakaii dine'e	? -	----
269a	Brian	"	"	
270.	Thomas	"	"	
271.	Dinella	Tsenjikini	"	
271a	Amber	"	"	
272.	Collette	"	"	

TABLE 6.13. (continued)

273. Jenelle		"	"
273a Shannon		"	"
273b Cassandra		"	"
	D1		
274. unknown		unknown	? - ?
275. Tlah yil bahe		Tsenjikini	? - ?
276. Max Lee		"	?
277. Joe Lee		"	? - ----
278. unknown		unknown	?
279. Sharon		"	? - ----
280. Tom		"	"
281. John		"	"
282. Barbie		"	"
283. Effie		"	"
284. Kee		"	"
285. Harry		"	"
286. Betty		"	"
287. Mary Lou		"	"
288. Wilson		"	"
289. Joann		"	"
290. Dorothy		"	"
	D2		
291. Luke Johnston		Tachii'nii	? - ?
292. Sherman Dugi		unknown	? - ----
293. Rebecca		Tsenjikini	? - ?
294. Ruby		"	? - ----
295. Julius Chee		Tl'izilani	?
296. Betty		Tsenjikini	? - ?
297. Bessie		"	? - 1945
298. Della B. Yazzie		"	? - ----
299. Haskie Yazzie		Tl'izilani	1927 - ----
300. Bruce		Tsenjikini	?
301. Dennis		"	"
302. Vera		"	"
303. Kenny		"	"
304. Carolina		"	"
305. Ervin		"	"
306. Milton		"	"
	D3		
307. Salt Man's Son		Todich'ii'nii	? - ?
308. unknown		unknown	?
309. Lucy		Tsenjikini	?
310. Nevy Jensen		unknown	? - ----
311. Sallie		Tsenjikini	? - ----

TABLE 6.13. (continued)

312.	Wilson Curley	unknown	?	
313.	Charly	Tsenjikini	? - ?	
314.	William	"	? - ----	
315-16.	unknown	"	? - ?	
317.	James	Tsenjikini	? - ----	
318.	Mildred	"	? - ----	
319.	Pete Schmallie	Tl'aashchi' i	? - ----	
320.	Elsie	unknown	"	
321.	John	Tsenjikini	"	
322.	Mary Ann	unknown	"	
323.	Roger	Tsenjikini	"	
324.	Joseph	unknown	"	
325.	Julie	Tsenjikini	"	
326.	Jerry	"		
327.	unknown	unknown	?	
328.	Martha	Tsenjikini	? - ----	
329.	Rena	"	"	
330.	Johnathan	unknown	"	
331.	Anthony	"	"	
332.	Jacqueline	"	"	
333.	Leander	"	"	
334.	Andrea	Tsenjikini	"	
335.	Adrienne	"	"	
336.	Ian	"	"	
337.	Crystal	"	"	
338.	Christopher	"	"	
		D4		
339.	Cleopatra Anthony	Tl'aashchi'i	c. 1885 - ----	
340.	Rose	"	? - ----	
341.	Owen Keams	unknown	"	
342.	unknown	Tl'aashchi'i	? - ?	
343.	Leland	"	? - ----	
344.	Woman from Greasewood	unknown	? - ----	
345-46.	unknown	Tl'aashchi' i	? - ?	
347.	Calvin	"	? - ----	
348.	Thelma	"	1919 - ----	
349-51.	unknown	"	? - ?	
352.	Martha	"	? - ----	
353.	unknown	unknown	?	
354.	David	Tl'aashchi'i	?	
355.	Freddie	"	? - ----	
356.	Raymond	"	"	
357.	Matthew	"	"	
358.	Marie	"	"	
359.	Margaret	"	"	
360.	Alice	"	"	

TABLE 6.13. (continued)

361.	Freida	"	"
362.	Mary Lou	"	"
363.	Anthony	"	"
364.	Rosita	"	"
365.	Cindy	"	"
366.	Lucien	"	"
367.	Lorinda	"	"
368.	Lucille	"	"
369.	Leland Jr.	"	"
370.	unknown	"	"
371.	unknown	"	"
372.	Stella	unknown	"
373.	Mary	"	"
374.	Sally	"	"
375.	Lilly	"	"
376.	Alfred	"	"
377.	Jimmy	"	"
378.	Bertha	"	"
379.	Nora	"	"
380.	Roy	"	"
381.	Arthur	"	"
382.	Jerry	"	"
383.	Raymond	Tl'aashchi'i	"
384.	Lee	"	"
385.	Max	"	"
386-388.	unknown	"	"
389.	Robert	"	"
390.	Jimmy	"	"
391.	Mary Ann	"	"
392.	Connie	"	"
393.	Delbert	"	"
394.	Helen Singer	unknown	"
395.	Ferrill	"	"
396.	Willis	"	"
397.	Martella	"	"
398.	Pamela	"	"
399.	Monte	"	"
400.	Ava	"	"

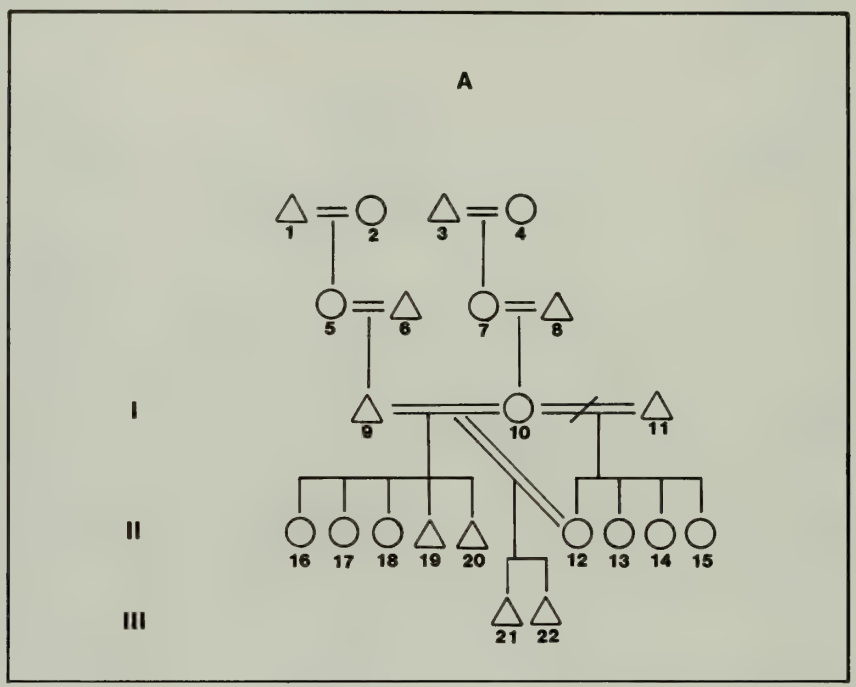
D5

401.	Tellie Eanna	Todich'ii'nii		?
402.	unknown	Kiyaa'aanii		"
403.	Katherine	Kinlichii'nii	1923	- ----
404.	Black Mesa Man	unknown		?
405.	Virgil Tso	Tlizilani	?	- ?

TABLE 6.13. (continued)

409. Donald Begay	Kiyaa'aanii	?	- WWII
410. Clark Smith	"	?	- ----
411. Harry	"	?	
412. Della S. Yazzie	"	?	- ----
413. Roy Yazzie	unknown	?	
414. Tom Dayzie	"	"	
415. Stella Smith	Kiyaa'aanii	?	- ----
416. ? Adakai	unknown	?	
417. Charley	Kinlichii'nii	1939	- ----
418. Elanor	"	?	- ----
419. Jim	"	1945	- ----
420. Roy	"	?	- ----
421. Polly	"	c. 1958	- ----
422. Richard	"	?	- ----
423. Ernest	"	"	
424. Kate	"	"	
425. Judy	"	"	
430. Stanley	(adopted)	?	- ----
431. Isabel	Kiyaa'aanii	"	
432. Alan	"	"	
433. Roy	"	"	
434. Helen	"	"	
435. Helen Davis	"	"	
436. Anthony Davis	unknown	"	
437. Tony	Kiyaa'aanii	1979	- ----
438. Aaron	"	?	- ----
439. Myron	"	?	- ----

TABLE 6.13. (continued)



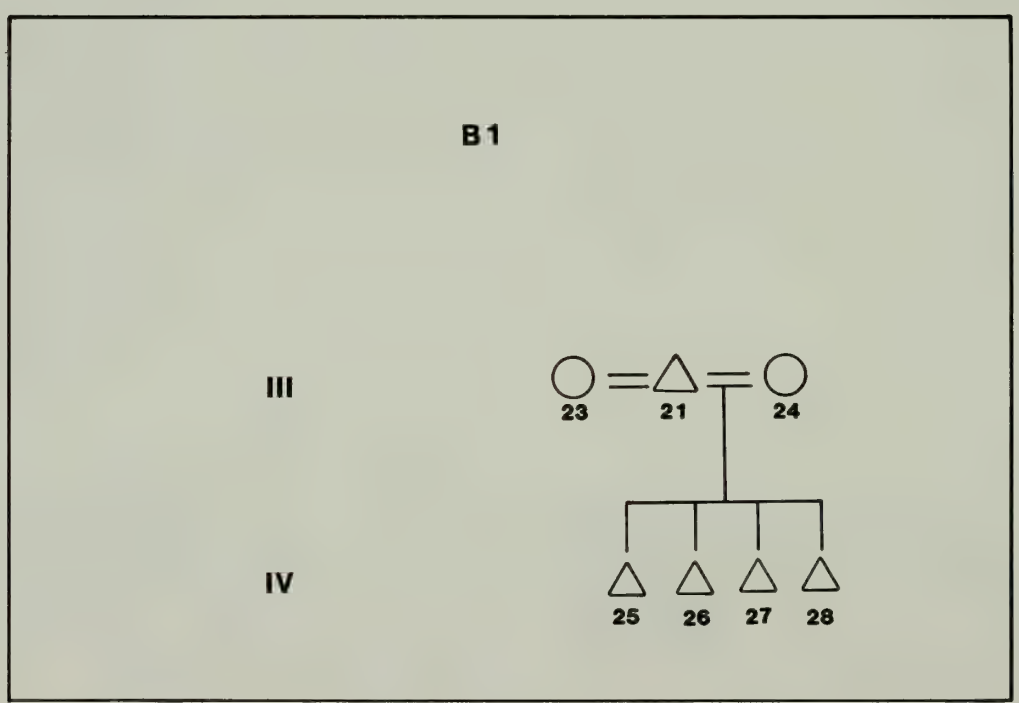


TABLE 6.13. (continued)

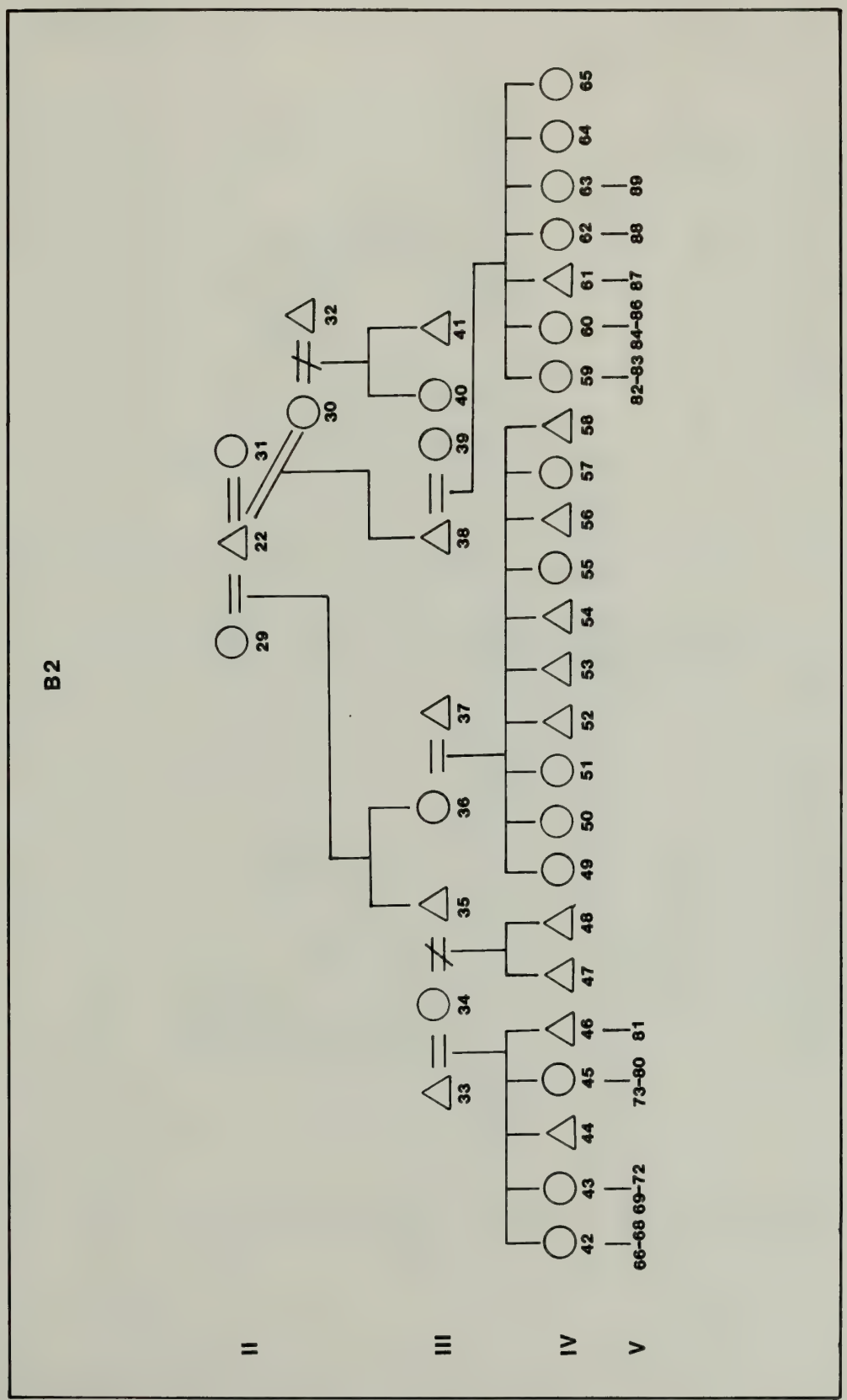
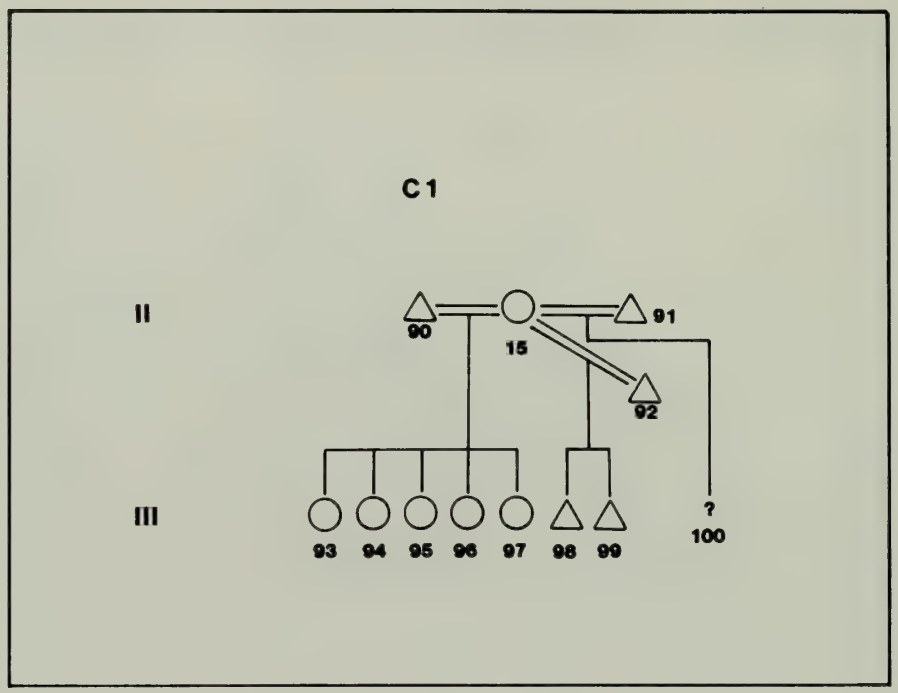


TABLE 6.13. (continued)



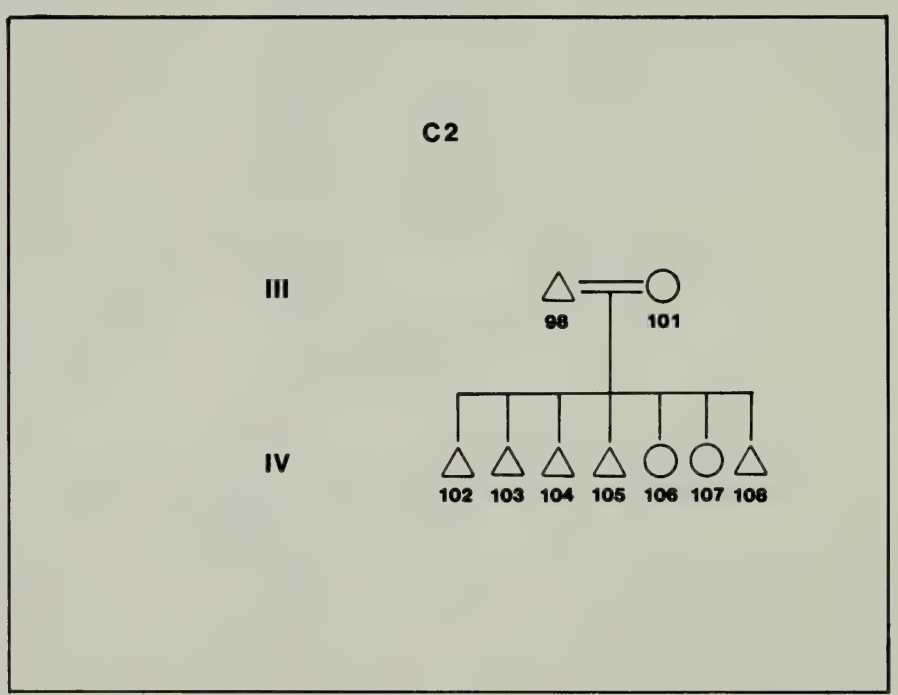


TABLE 6.13. (continued)

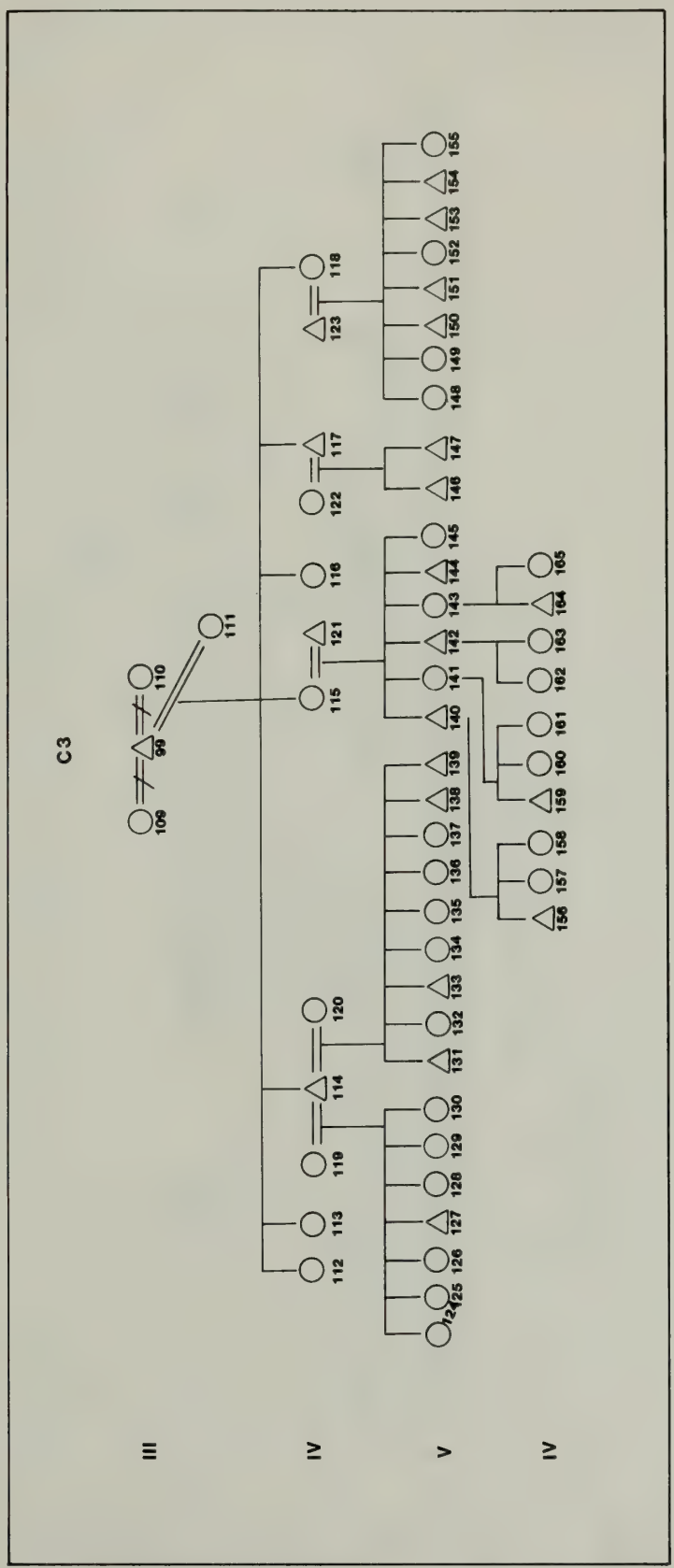


TABLE 6.13. (continued)

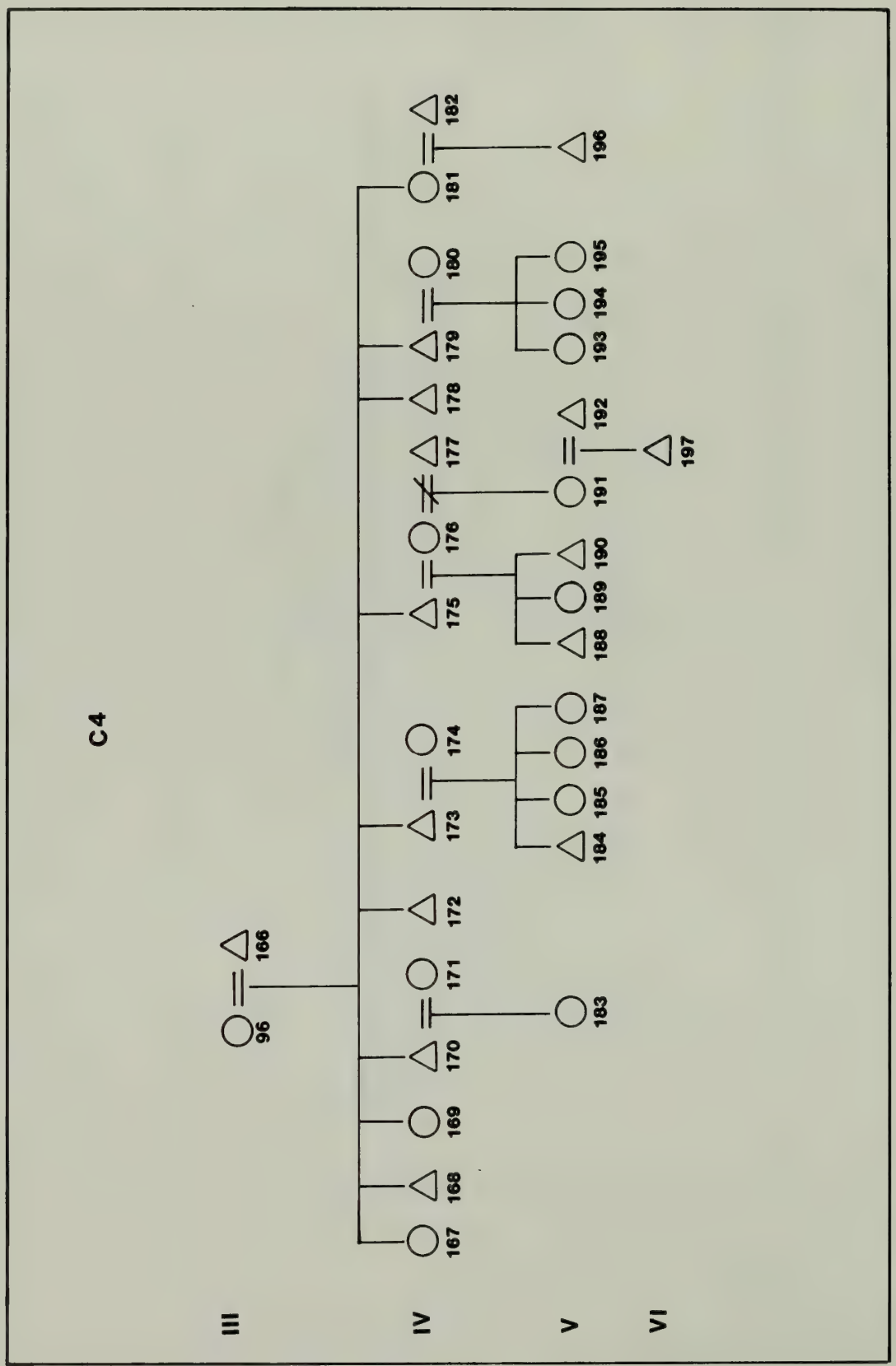


TABLE 6.13. (continued)

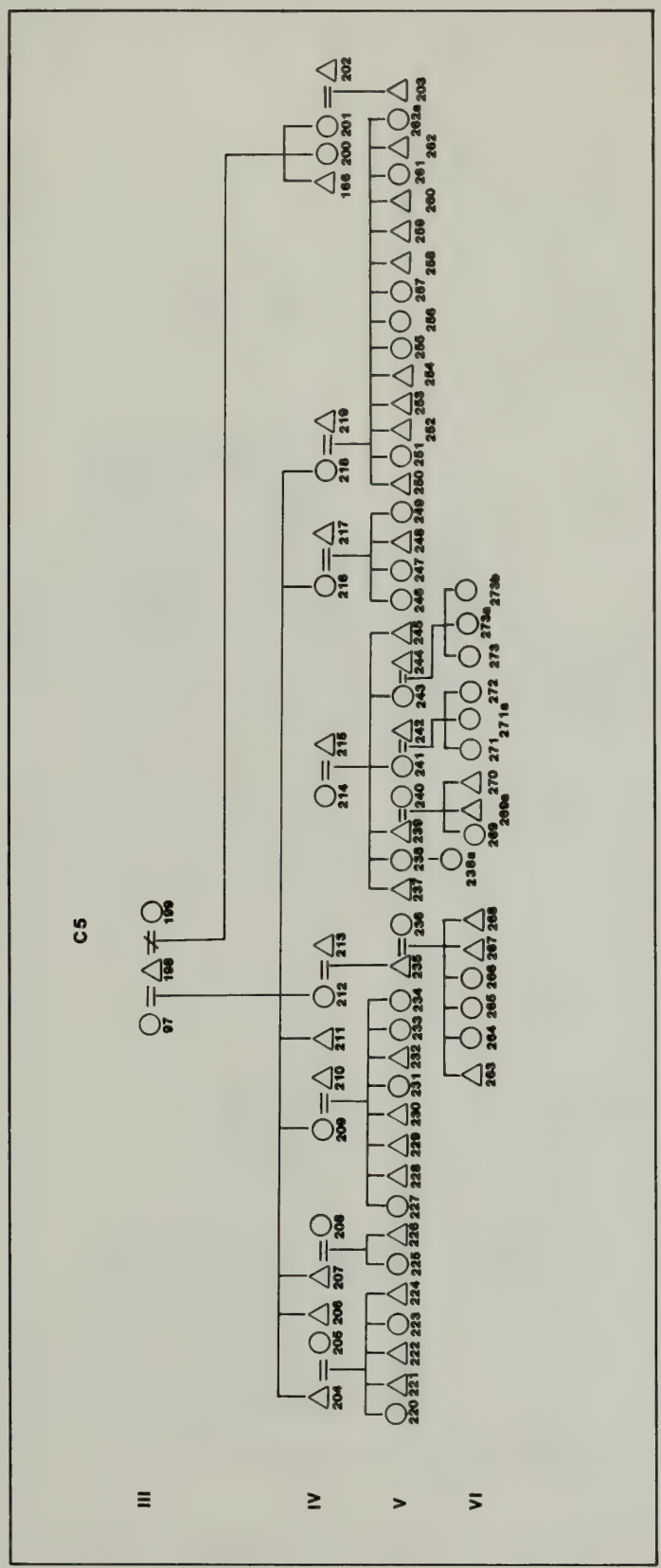
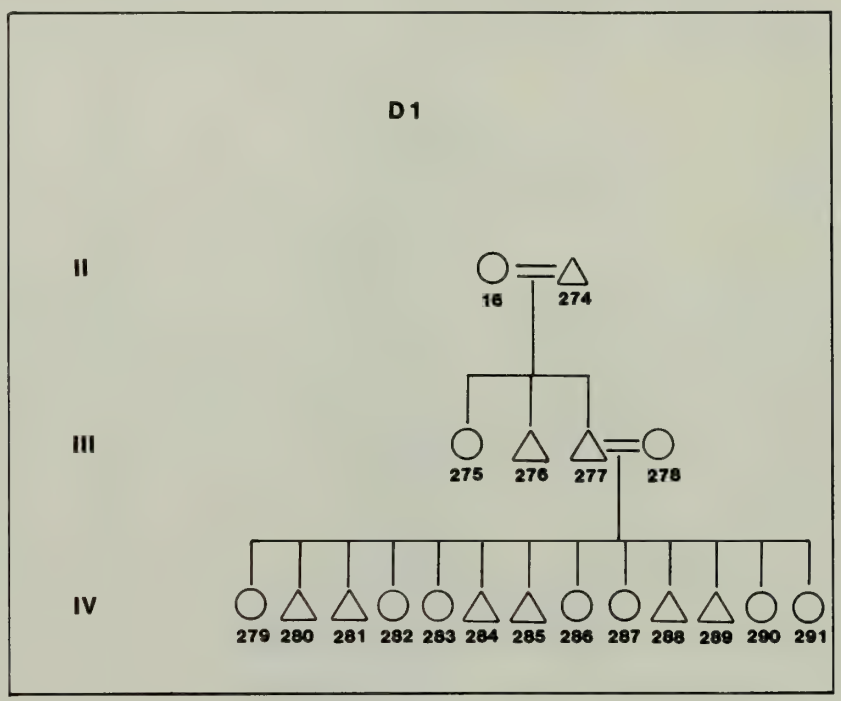


TABLE 6.13. (continued)



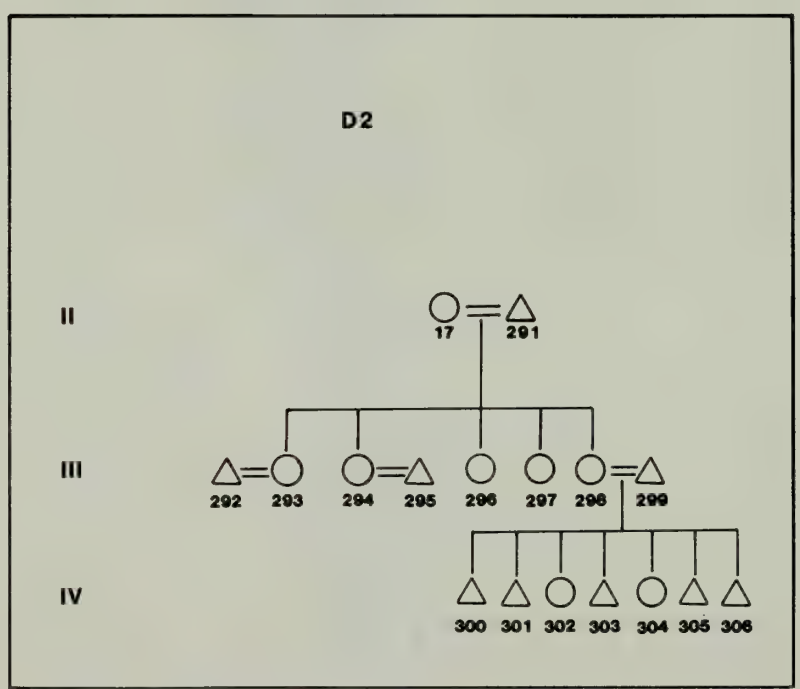


TABLE 6.13. (continued)

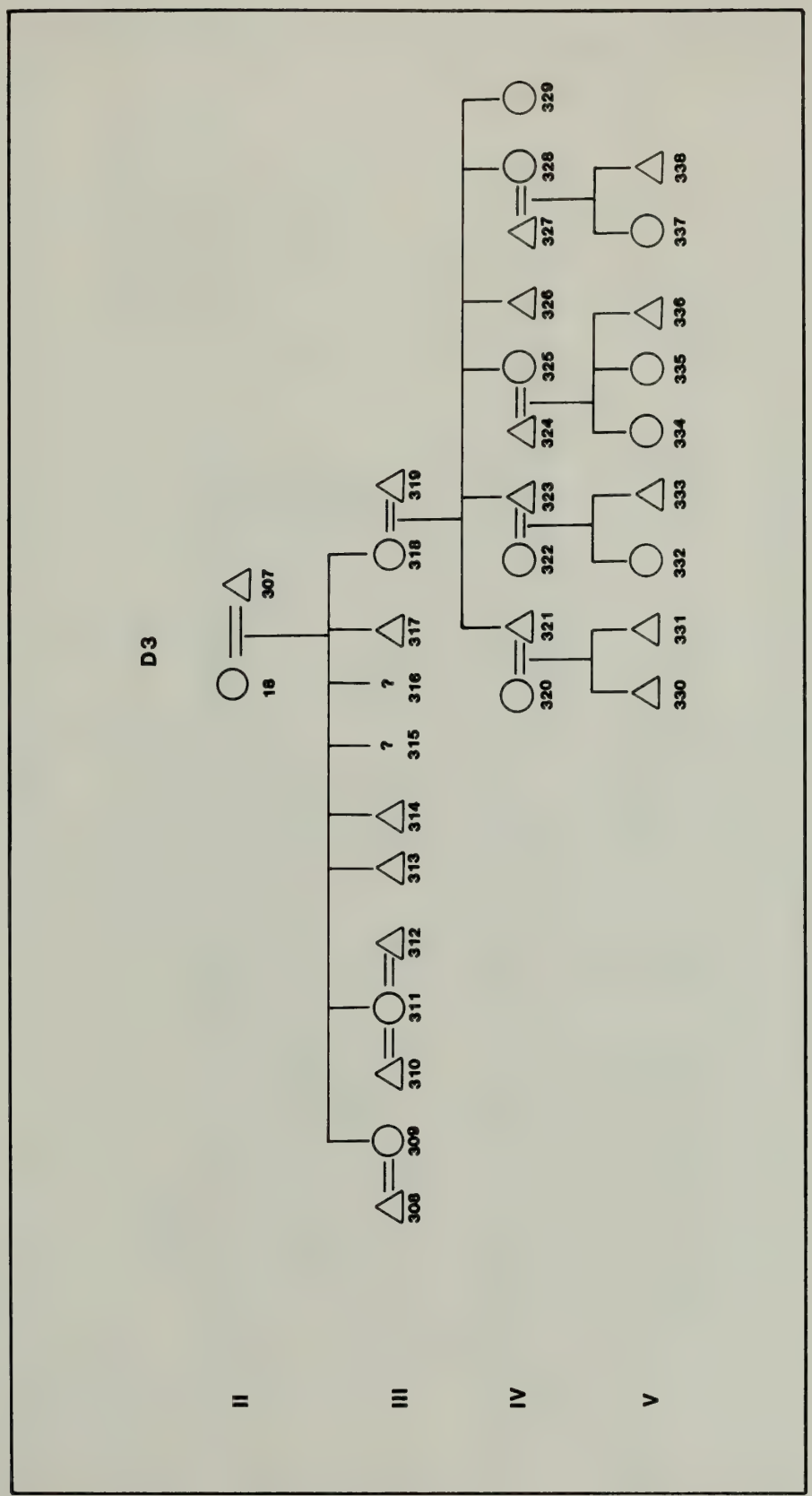


TABLE 6.13. (continued)

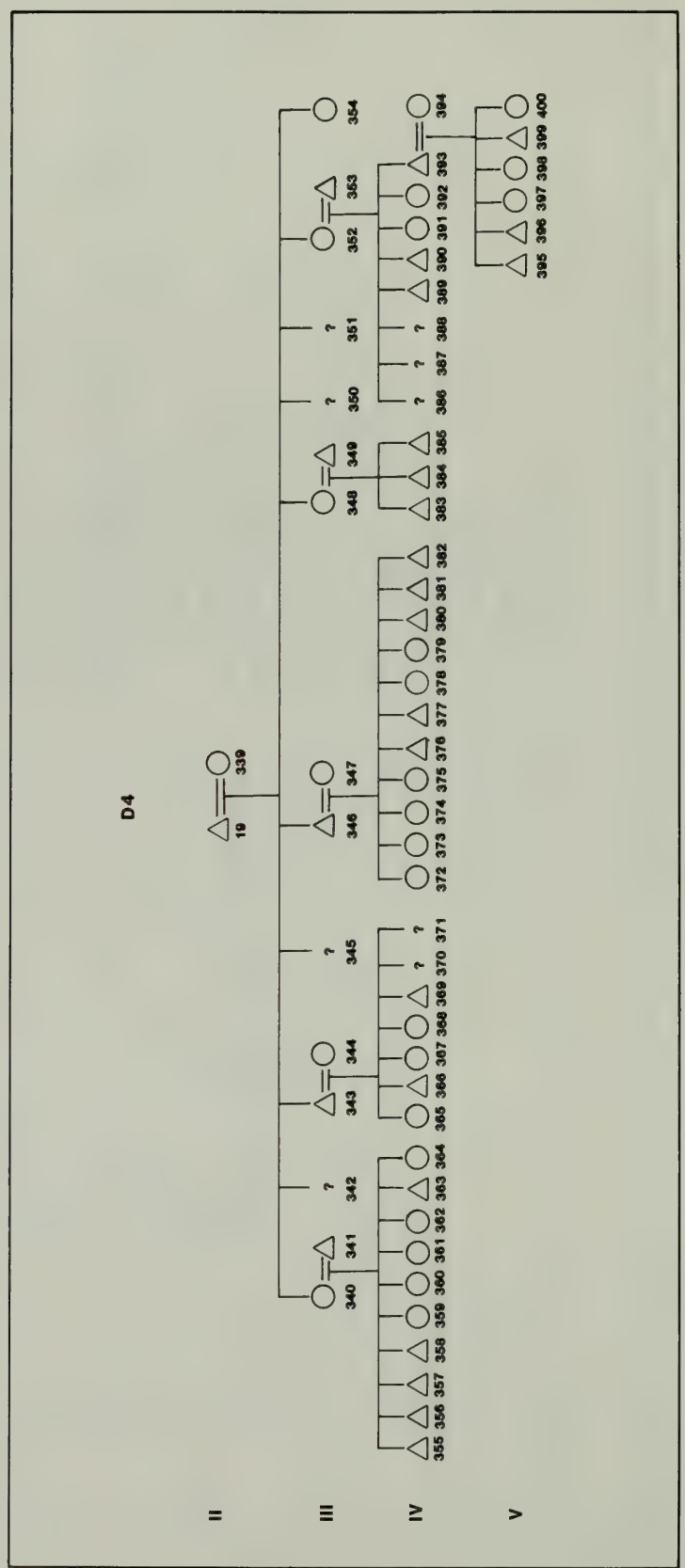
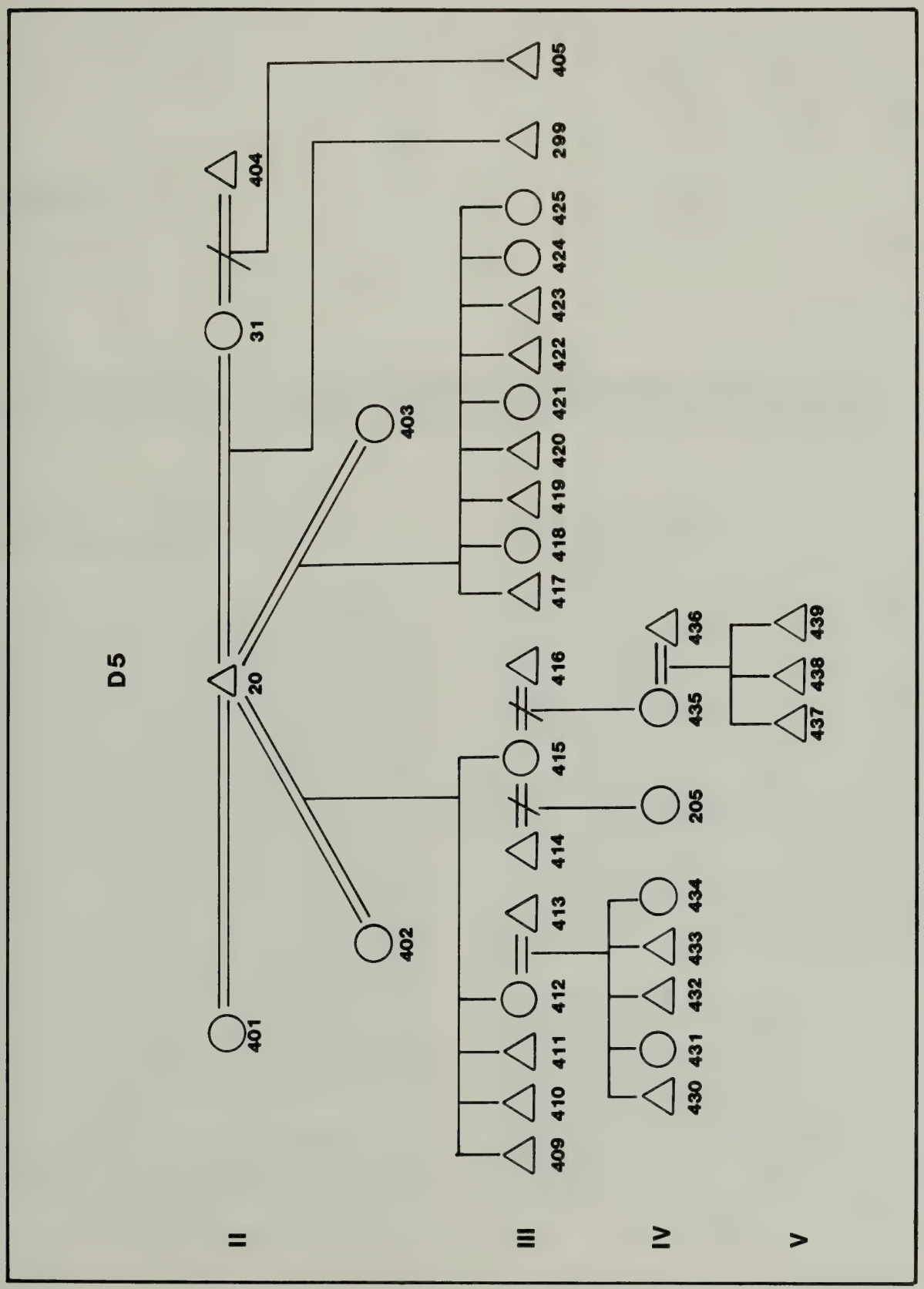


TABLE 6.13. (concluded)



Chapter 7

MATERIAL CULTURE PERSPECTIVES

By Bruce A. Anderson and Stan A. McDonald

This chapter discusses all of the various cultural items collected during the archeological survey process (from 1981 through 1987) except prehistoric ceramic items (see Chapter 8). This chapter is divided into numerous sections, of which the analysis of flaked lithic artifacts is the largest. Other sections include shell; glass; metal and other objects; and ground, smoothed, and flaked stone. In order to provide a more complete description of these material items, several tables, drawings, and photographs will be included within the text. Items not discussed here include foodstuffs, textiles, and cordage items because they were not located during the survey (see Chapter 3 for reference to these materials).

The objectives of this chapter are to provide basic descriptive data for the artifact assemblage (excluding ceramics). Collection strategies have been described in Chapter 1, but it should be noted that, within those collections, there was also some artifact sampling to select for certain types of artifacts and provide a full range of the material culture observed. Specialized treatment was required for certain artifacts: WUPA 2432, a prehistoric basket (cleaning and stabilizing); WUPA 1893, a .45 caliber pistol (cleaning, unloading, and stabilizing); and restoration of two ceramic vessels. There may be some confusion to the reader on the differing number systems used in this final report. WS numbers refer only to sites, and WUPA numbers refer only to catalogued artifacts. All of the materials described here have been inventoried and catalogued. They are located now at the Western Archeological Center in Tucson, Arizona; the Southwest Cultural Resources Center in Santa Fe, New Mexico (a type collection only); and at Wupatki National Monument.

Shell

Worked shell items are found throughout the southwestern United States in prehistoric sites. There have been shell artifacts recovered from archeological sites in southwestern Colorado (Ezell 1937:9), but Arizona and New Mexico have yielded most of the materials found north of the Mexican border. It is quite evident that the Gulf of California was the major source of shell supply (Woodward 1936:117-125; Brand 1937:300-302; Ezell 1937:9; DiPeso, et al. 1974:385; and Haury 1976:306). There are also several references to how the shell was manufactured after it was collected (Woodward 1936:120-121; Ezell 1937:11-12; Pomery 1959:12-21; Francis 1982:713-714). Some manufacturing may have been done on the coast, but it appears that most was done at the home sites,where the residue of working shell is found (Ezell 1937:9; DiPeso, et al. 1974:385; and Haury 1976:305-307). No large accumulations of raw shell were recovered from Snaketown (Haury 1976:309), but shell working and trading shell items was very important (Haury:305-306). Shell working was obviously also very important at Paquime (Casas Grandes): 3,909,076 shells were recovered, and 3,821,051 of these were worked (DiPeso et al. 1974:385). Trading was also very important, and it is suggested that shell jewelry may have been a major commodity.

Before discussing items collected from the Wupatki survey, it should be noted that those specimens collected were not always identified genera or species. A list of those identified from the Wupatki Ruin excavations will follow, however.

A total of 17 shell artifacts were collected during the survey. Nine of these were Glycymeris sp. bracelet fragments (Table 7.1 and Figs. 7.1 and 7.2). The fragment illustrated in Figure 7.2 is very similar to one showing marginal nicking in Haury (1976:314). There were five shell beads recovered (Fig. 7.4), one tinkler (probably Conus sp.), an unworked umbo from a Glycymeris sp., an unknown fragment, and a cut and polished shell pendant fragment (Table 7.2 and Fig. 7.3). While this limited sample does not really provide much new information in the use of shell, it does supplement the collection from Wupatki Ruin and helps to better understand that shell was an important material for ornament manufacture. Twenty-three different genera or species of shells were identified from Wupatki Accession 33 (Vivian 1960). More than 1,600 worked pieces of 30 different marine species, one land snail, and two fossil crinoid stems were excavated from Wupatki Ruin (Stanislawski 1963:305). Those identified include:

Anodonta sp., Cardium elatutm, Cerithidea sp., Cerithidea albonodosa, Conus sp., Conus perplexus, Conus virgatus, Glycymeris sp., Glycymeris maculata, Haliotis fulgens, Nassarius iodes, Neritina lutsofasciata, Oliverella sp., Olivella biplicata, Olivella dama, Oreohelix yavapai, Pecten circularis, Pyrene fuscata, Spondylus (?), and Turritella leucostoma (Vivian 1960). In addition, those identified in Stanislawski (1963:306-343) include: Agaronia testaceae, Columbella major, Conus comptus, Conus regularis, Haliotis corrugata, Haliotis refescens, Murex nigrius, Nassarius leupcops, Oliva spicata cumingii, Oliva spicata venulata, Olivella bacteria, Polinices reclusianus, Strombus galeatus, Trivia solandra, Turitella tigrina, Arca campechiensis pexata, Chama echinata, Pectin vogdesi, Pecten dentatus, Dentalium nehexigonum, Dentalim hexigonum, and Dentalium semipolitum. There were no caches of raw-shell material

TABLE 7.1. Shell Bracelet Fragments.

Site Number	Catalogue Number	Section	Umbo	Bevel	Natural Margin	Band/ Thickness	Modification	Applied Decoration	Condition
WS-1723	WUPA 3842	Square/ rectanguloid	Plain	Not beveled	Lower edge flat	Plain 4 mm	N/A	N/A	Fragmentary[a]
WS-2339	WUPA 3844	Trianguloid	N/A	Exterior	Lower edge flat	Plain 4 mm	N/A	N/A	Fragmentary[b]
WS-704	WUPA 3849	Square/ rectanguloid	N/A	Exterior and Interior	Ground	Plain 4 mm	N/A	N/A	Fragmentary
WS-1356	WUPA 3851	Square/ rectanguloid	N/A	Not beveled	Lower edge flat	Plain 4 mm	N/A	N/A	Fragmentary
WS-1400	WUPA 3852	Square/ rectanguloid	Plain Triang-uloid	Not beveled	Lower edge flat	Plain 3 mm	N/A	N/A	Fragmentary
WS-1864	WUPA 3855	Square/ rectanguloid	N/A	Not beveled	Lower edge flat	Plain 5 mm	N/A	N/A	Fragmentary
WS-1109	WUPA 3860	Ovoid	N/A	Interior	Lower edge flat	Plain 4 mm	N/A	N/A	Fragmentary
WS-1356	WUPA 3861	Square/ rectanguloid	N/A	Not beveled	Lower edge flat	Plain 4 mm	N/A	N/A	Fragmentary
WS-1395	WUPA 3865	Square/ rectanguloid	N/A	Exterior	Lower edge flat	Plain 4 mm	N/A	N/A	Fragmentary

[a]See Figure 7.1.
[b]See Figure 7.2.

found at Wupatki. Items of worked shell were cut beads, pendants, tinklers, bracelets, carved shell, cut shell, and trumpets.

In order to provide some comparisons with other sites where shell occurs in Arizona, and especially in the Flagstaff area, several references were reviewed: Winona Village (McGregor 1941:214-226), Ridge Ruin (McGregor 1943:281-284), Homolovi II (Urban n.d.:1-8), Ventana Cave (Haury 1975:361-374), Snaketown (Haury 1976:305-321, and the greater Sinagua area (Colton 1960:80 and Pilles 1987a:10). Other sites and areas considered were

FIGURE 7.1. WUPA 3842, Shell Bracelet Fragment.

FIGURE 7.2. WUPA 3844, Shell Bracelet Fragment.

FIGURE 7.3. WUPA 3841, Shell Pendant.

FIGURE 7.4. WUPA 3840, Shell Bead.

Chaco Canyon (Judd 1954:87-98), Pecos (Kidder 1932:183-194), Gila Cliff Dwellings (Fenner 1986:175-181), Gran Quivira (Van Valkenburgh 1961:136; McKusick 1981:40-42), and Casa Grandes (DiPeso et al. 1974, 6:385-526).

Because these discussions are lengthy and the amount of shell materials are quite extensive, only reference is provided within this section. Tinklers from Pecos Pueblo were univalve shells cut to a bell-like shape and perforated for suspension. Their use was probably for rattles or fringe for garments (Kidder 1932:190). Shell trumpets are not commonly found in most southwestern sites, although two were found at Wupatki (Boekelman 1936:27-31; Stanislawski 1963:343; Haury 1976:321). Shell bracelets from Snaketown were of three types: Type 1, thin band, thickness 2.5-4.0 mm; Type 2, medium band, thickness 4.0-5.0 mm; and Type 3, broad band, thickness 5.0-17.0 mm (Haury 1976:313). All those from the survey, with the exception of one example, are Type 1 (see Table 7.1); WUPA 3855 is Type 2. The Hohokam produced shell pendants, generally showing a silhouette design (Jernigan 1978:235-237), but they reached their peak in jewelry design with carved shell bracelets.

Several trade routes have been suggested from the Gulf of Mexico, the Pacific Ocean, and the Gulf of California (Tower 1945:37-46). The discovery of several sites near the Gulf of California in Sonora with thousands of Glycymeris "blanks" suggests that this was the major source area (Brand 1937:302). Probably many of the shells were traded from Sonora to the Gila River and up along this riverine system into eastern Arizona and western New Mexico (Stanislawski 1961:22). The Wupatki and Winona shell collections appear to be quite similar and exhibit a strong relationship to the Hohokam area (Stanislawski 1963:349-351). Casas Grandes also appears to be a major manufacturing and distribution center for shell items (DiPeso et al. 1974:385). Some materials could have been traded through the Mimbres Mogollon area into the Cibola Anasazi area and filtered then to

TABLE 7.2. Other Shell Objects.

Site Number	Catalogue Number	Length	Width	Thickness	Genus	Remarks
WS-1395	WUPA 3868	15 mm	7 mm	6 mm	*Olivella* sp.	Bead
WS-328	WUPA 3863	6 mm	5 mm	5 mm	Unknown	Natural shell with the ends cut off to form the bead
WS-2178	WUPA 3856	5 mm	6 mm	5 mm	Unknown	Natural shell with the ends cut off to form the bead
WS-1400	WUPA 3853	3 mm	4 mm	.01 mm	Unknown	Small bead
WS-404	WUPA 3840	0.6 mm	0.6 mm	2 mm	Unknown	Purple and white worked bead with hole, see Figure 7.4
WS-1589	WUPA 3866	35 mm	30 mm	20 mm	*Conus* sp.	Tinkler
WS-2639	WUPA 3859	34 mm	15 mm	6 mm	*Glycymeris* sp.	Natural umbo
WS-1843	WUPA 3867	50 mm	19 mm	5 mm	Unknown	Fragment
WS-1238	WUPA 3841	27 mm	13 mm	3 mm	Unknown	Polished and cut shell pendant fragment, see Figure 7.3

TABLE 7.3. Glass Objects.

Site Number	Catalogue Number	Length	Width	Thickness	Remarks	Marks
WS-2118	WUPA 3879	204 mm	60 mm	9 mm	Root beer bottle made of clear glass with orange and white paint. The bottle has a crown top neck and was manufactured by an automatic machine process after A.D. 1903. It was made by the Laurens Glass Works (since 1913).	PAT NO 99839 'L G Wa Hires
WS-2118	WUPA 3880	234 mm	60 mm	7.5 mm	"Thrill" soda bottle made of clear glass with red and white paint. The bottle has a crown top neck, and was made using an automatic machine process. Other marks are "Green & Green, Houston, Texas" and "Nackard Bottling Co., Flagstaff, Arizona". It was made by Glass Containers Corp. (since 1945).	S 3 5122 1
WS-2274	WUPA 3881	198 mm	58 mm	6 mm	"Coca-cola" bottle made of aqua glass. It has a crown top neck and was made with an automatic machine process after A.D. 1903. Additional marks are "Bottle Pat. D-105529". It was made by the Chattanooga Glass Co. (since 1927).	32 C 51 PHOENIX ARIZ
WS-306	WUPA 3884	38 mm	28 mm	0.5 mm	Small square clear glass bottle with a continuous thread. It was made by an automatic machine process after A.D. 1903. The maker is unknown. (see Figure 7.5).	7 8 7
WS-664	WUPA 3886	51 mm	31 mm	4 mm	Small round clear glass bottle which was made after A.D. 1903. It was made by T.C. Wheaton Co. (since 1946) with an automatic machine process.	W 5
WS-1837	WUPA 3887	58 mm	32 mm	4 mm	Small glass bottle which is round and made of clear glass. The bottle was made by T. C. Wheaton Co. after A.D. 1903 and before A.D. 1920. It was manufactured by automatic machine with a "Packer Neck".	TCW CO 36 USA
WS-20	WUPA 1952	45 mm	27 mm	4 mm	Small round clear glass double-banded bottle which had a double bead neck. It was made utilizing a closed mold, semi-automatic machine process, probably between A.D. 1880 and A.D. 1903. The maker is unknown. (see Figure 7.6).	447
WS-106	WUPA 3875	209 mm	57 mm	7 mm	Green glass bottle with a crown top neck. The writing on the side is "Pluto Water America's Physic". The bottle was made with an automatic machine process after A.D. 1903. It was made by the Root Glass Co. (since 1901 to 1932). (see Figure 7.7).	2319FF ROOT 32
WS-292	WUPA 3876	143 mm	35 mm	4 mm	"Alka-seltzer" bottle with a continuous thread made of clear glass. It was made utilizing an automatic machine process after A.D. 1903. The maker is unknown.	A - S 23
WS-292	WUPA 3877	58 mm	35 mm	3 mm	Wide mouth jar with a continuous thread and of clear glass. It was made after A.D. 1903 utilizing an automatic machine process. The maker was the Knox Glass Bottle Co. of Mississippi (from 1932-1953, or later).	1412 J 10

TABLE 7.3. (concluded).

Site Number	Catalogue Number	Length	Width	Thickness	Remarks	Marks
I.O.	WUPA 4056	73 mm	13 mm	14 mm	Blue glass bottle which is octagonal in shape with a continuous thread. It was made by an automatic machine process after A.D. 1903. The bottle may have been used for perfume. (see Figure 7.8).	
WS-292	WUPA 3878	45 mm	40 mm	6 mm	Bottle bottom fragment with the letter "A" printed on it.	
WS-292	WUPA 3878	60 mm	41 mm	7 mm	Bottle bottom fragment - clear glass with "ROM" printed on the bottom. This bottle was a 1 pint size.	
I.O.	WUPA 1997	48 mm	30 mm	6 mm	Clear glass fragment.	
WS-1949	WUPA 3889	45 mm	27 mm	5 mm	Brown glass fragment.	
WS-2144	WUPA 3890	35 mm	39.5 mm	0.7 mm	Insulator fragment with some re-touched flaking on the edge.	
WS-2200	WUPA 3891	34 mm	32 mm	0.6 mm	Insulator fragment.	
WS-2200	WUPA 3891	51 mm	46 mm	0.6 mm	Insulator fragment.	
WS-2200	WUPA 3892	71 mm	55 mm	12 mm	Top 1/2 of insulator.	
WS-2200	WUPA 3893	31 mm	54 mm	17 mm	Insulator fragment.	
WS-330	WUPA 3885	16 mm	16 mm	16 mm	Marble.	
WS-306	WUPA 3883	16 mm	16 mm	16 mm	Marble.	
WS-1849	WUPA 3888	12 mm	16 mm	16 mm	Marble.	
WS-1795	WUPA 3525	4.9 cm	4.0 cm	1.7 cm	Japanese ceramic figurine (porcelain) which is an elephant playing a guitar. (see Figure 7.9).	

Wupatki, but we do not know if this in fact happened prehistorically. The large numbers of parrots found also support this possible scenario (see Chapter 3).

Glass

A total of 24 glass and porcelain objects were collected during the survey. Three were soda pop bottles, 10 were other types of bottles, 5 were insulator fragments, 3 were marbles, and 1 was a ceramic figurine (Table 7.3). All known bottle marks were identified from Toulouse (1971). The number of soda pop bottles observed and collected reflects that most of the Navajo sites date before 1953, when soda pop was introduced in metal containers (Ward et al. 1977:268). Other bottles probably contained many varying substances (Figs. 7.5 - 7.8). All of the marbles appear to have been machine made. Early machine made marbles as distinquished from the handmade types, by their opaqueness (Randall 1971:105). The porcelain figurine probably was a toy (Fig. 7.9).

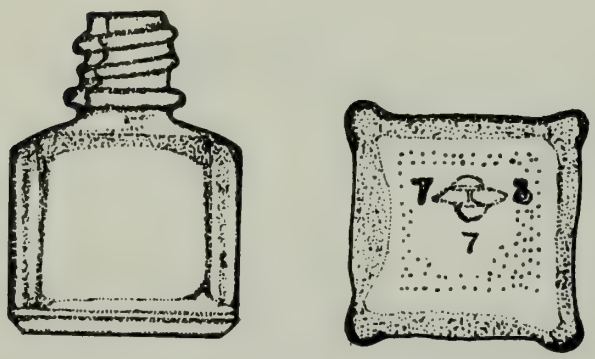


FIGURE 7.5. WUPA 3884, Clear Glass Bottle.

FIGURE 7.6. WUPA 1952, Clear Glass Bottle.

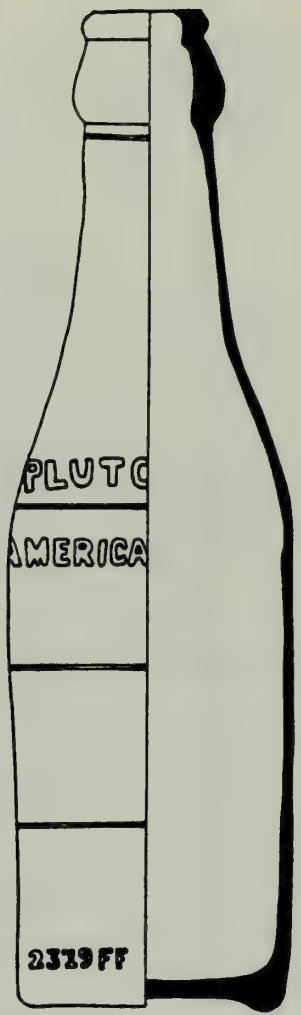


FIGURE 7.7. WUPA 3875, Green Glass Bottle.

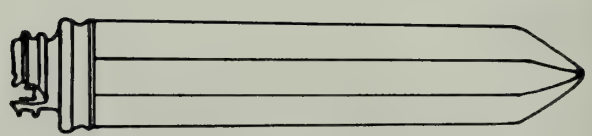


FIGURE 7.8. WUPA 4056, Blue Glass Bottle.

FIGURE 7.9. WUPA 3525, Ceramic Figurine.

Metal

Tin cans were observed at many of the inventoried historic sites. These metal cans are commonly called "tin cans" even though many have no tin in them and are not tin-plated (Busch 1981:95, 99). WUPA 4051 was a Prince Albert tobacco can with considerable paint utill remaining on the surface and a date of 1932 scratched into the can. The pocket tobacco tin was the equivalent of a cigarette package. WUPA 4073 was a tin can made into a drinking cup with a wire handle (Fig. 7.13). Often objects thought of as trash were utilized for secondary purposes (Ward, et al. 1977;273). The mining claim already described was found in WUPA 4071, a square can. This can had

TABLE 7.4. Metal Objects.

Site Number	Catalogue Number	Length	Width	Thickness	Material	Remarks
WS-2539	WUPA 4080	218 mm	160 mm	12 mm	Metal (steel)	Double welded hook.
WS-2539	WUPA 4080	210 mm	125 mm	6 mm	Metal (steel)	"Diamond" brand double spring trap - No. 15.
WS-1526	WUPA 4064	174 mm	80 mm	0.5 mm	Metal ("tin")	Wire spool end molded in shape of a star. Writing on the inside is "HOF" and "1917".
WS-1877	WUPA 4070	85 mm	75 mm	2 mm	Metal (steel)	Sheep or cow bell with a homemade wire clapper (see Figure 7.10).
WS-60	WUPA 4051	115 mm	77.5 mm	23 mm	Metal ("tin")	"Prince Albert" tobacco can with considerable paint on the surface. "1932" was scratched into the can.
WS-1505	WUPA 4063	420 mm	30 mm	3 mm	Metal (steel)	"Victor" brand double spring trap
WS-1505	WUPA 4063	515 mm	815 mm	18 mm	Metal (steel)	Drag chain with 5 links of galvanized steel added to the original chain.
WS-1881	WUPA 4072	150 mm	46 mm	2 mm	Metal (aluminum)	Stakebed toy truck, "Tootsitoy - made in United States of America". Wheels on the back are replaced with wire.
WS-2291	WUPA 4079	150 mm	29 mm	2 mm	Metal (silver?)	Spoon - "Albert Pick & Company" - engraved "The Mayor".

TABLE 7.4. (continued).

Site Number	Catalogue Number	Length	Width	Thickness	Material	Remarks
WS-2284	WUPA 4077	18 mm	18 mm	1 mm	Metal (copper)	Lincoln head (wheat) penny, dated "1941".
WS-2284	WUPA 4078	30 mm	30 mm	3.5 mm	Metal (copper?)	Religious metal - writing on it is "Saint Christopher be my guide".
WS-1908	WUPA 4073	111 mm	119 mm	3 mm	Metal ("tin" and wire)	Tin can with a wire handle to form a drinking cup. (see Figure 7.13)
WS-2668	WUPA 4083	196 mm	200 mm	1 mm	Metal (chrome)	A "V-8" hubcap off an automobile tire.
WS-2274	WUPA 4075	115 mm	115 mm	12 mm	Metal (steel)	Wheel off a toy wagon from Dump "B".
WS-1940	WUPA 4071	108 mm	75 mm	2 mm	Metal ("tin")	Square can (with claim inside) with a round top (screw on).
WS-2539	WUPA 4080	2.35 mm	51 mm	3 mm	Metal (steel)	Two different types of chain with a metal tag wired on. Three different clasps were used.
WS-1536	WUPA 4066	83 mm	75 mm	1 mm	Metal (steel)	Cow bell with a homemade clapper of wire and a steel nut.
WS-1529	WUPA 4065	90 mm	12 mm	3 mm	Metal (steel)	Pocket knife with 3 blades (2 are broken), and rusted open. The handles are missing.
WS-2268	WUPA 4082	85 mm	22 mm	6 mm	Metal (unknown)	Copper colored alloyed metal strap with holes.
WS-1839	WUPA 4068	187 mm	85 mm	35 mm	Metal (steel)	Single bit axehead - "Falls City", made by the Kelly axe and tool works.
WS-1839	WUPA 4069	310 mm	24 mm	13 mm	Metal (steel)	Blacksmith's forceps. (see Figure 7.11).
WS-306	WUPA 3882	10 mm	17 mm	3 mm	Metal (copper or brass)	Military button with stars forming the design on top. Rusty brown in color.
WS-2274	WUPA 4076	231 mm	99mm	2 mm	Metal ("tin")	Toy car which is an orange sports coupe, from Dump "D".
I.O.	WUPA 4059	157 mm	20 mm	1 mm	Metal (steel)	Homemade knife - blade only, with two holes for a handle.
WS-1016	WUPA 4062	27 mm	23 mm	1 mm	Metal (10 k gold)	Fraternity ring - jet or onyx set, with " K" on a cross within the set. Initials "RMD" on inside of band.
WS-1537	WUPA 4067	112 mm	100 mm	0.5 mm	Metal ("tin")	Cowboy and horse cut from a tin can. (see Figure 7.12)

TABLE 7.4. (concluded).

Site Number	Catalogue Number	Length	Width	Thickness	Material	Remarks
WS-1942	WUPA 4074	175 mm	232 mm	0.6 mm	Metal ("tin")	Cut U.S.F.S. sign in the shape of an eagle - yellow paint on the surface. (see Figure 7.14)
WS-2638	WUPA 4081	250 mm	176 mm	0.6 mm	Metal ("tin")	Yellow U.S.F.S. sign with writing - "One Heifor Calf Born here to one High Horned Cow - Feb 26, 1972".
I.O.	WUPA 4060	237 mm	176 mm	0.5 mm	Metal ("tin")	Yellow U.S.F.S. sign with writing - "Francisco Moran - Zamora, Espana 1 & 977 - SUM KITE 3/7/57 - Santiago Parra 1977".
I.O.	WUPA 1893	263 mm	88 mm	42 mm	Metal (steel)	.45 cal. pistol which required conservation treatment. (see Figure 7.15)

"Chesebrough" embossed into it. In 1880, Chesebrough Manufacturing Company Consolidated was founded; it made Vaseline petroleum jelly (Fike 1987:56). The most numerous cans noted were evaporated milk cans. Evaporated milk was used primarily for nursing lambs, not for the Navajo children. This is suggested by the location of many of these cans near small sheep pens. Today's condensed milk cans, which are very similar to the old hole-and-cap cans, have changed very little through time (Busch 1981:98). Tin cans have not been studied as extensively as glass bottles, partly because cans do not preserve as well as bottles.

There were several tools located during the survey process. Generally tools are used repeatedly unless broken or lost, and they were seldom left behind (Ward et al. 1977:272). These tools included two traps, two knives, an axe head, blacksmith's forceps, and a .45 caliber pistol. WUPA 4080 was a Diamond brand double spring trap, with a double welded hook attached to it. WUPA 4063 was a Victor brand double spring trap with a drag chain attached to it. WUPA 4059 was a homemade knife, and WUPA 4065 was a rusted pocket knife with 3 blades (two were broken). WUPA 4068 was a single-bit axehead made by the Kelly Axe and Tool Works. WUPA 4069 was a pair of blacksmith's forceps (Fig. 7.11). Finally, WUPA 1893 was a pistol (Fig. 7.15). This object was sent to the Museum Services Division in Harpers Ferry, West Virginia, for treatment and unloading. Marks are

FIGURE 7.10. WUPA 4070, Metal Bell.

FIGURE 7.11. WUPA 4069, Blacksmith's Forceps.

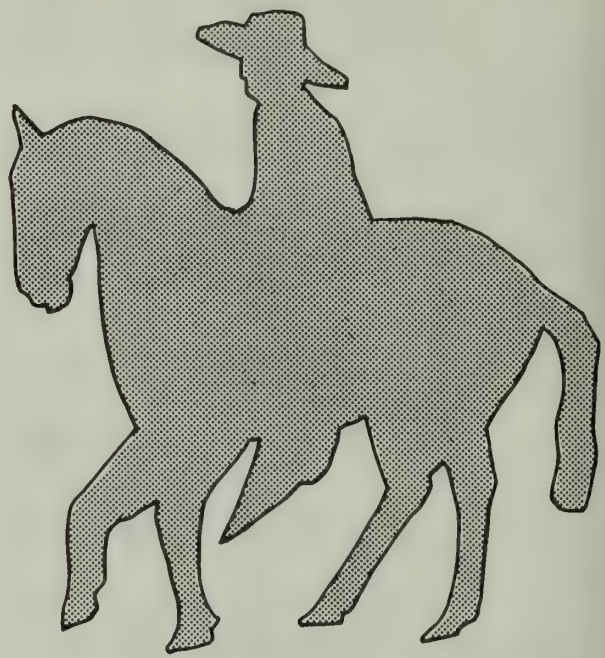


FIGURE 7.12. WUPA 4067, Cut Metal Cowboy.

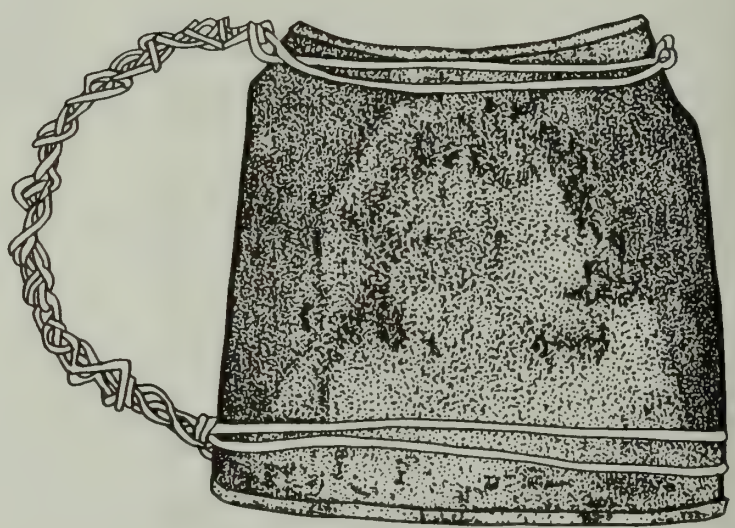


FIGURE 7.13. WUPA 4073, Tin Drinking Cup.

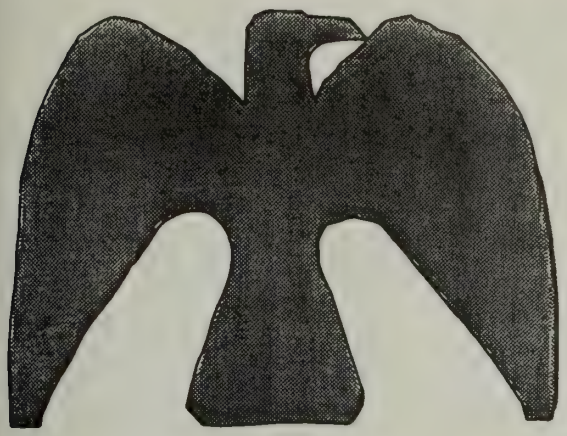


FIGURE 7.14. WUPA 4074, Cut Metal Eagle.

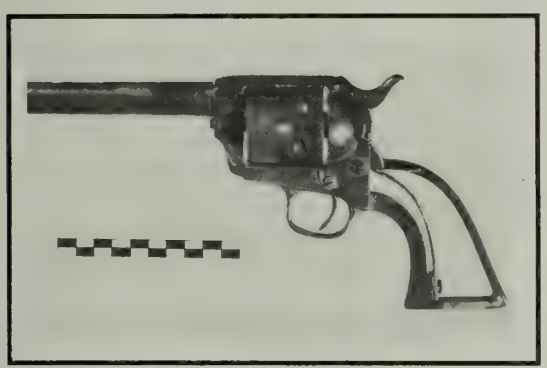


FIGURE 7.15. WUPA 1893, .45 Cal. Pistol, Colt Peacemaker.

Through these marks, it is known that this is a Colt single-action Army revolver, also referred to as a "Peacemaker."

Several other metal objects were located. WUPA 4070 is a bell with a handmade clapper (Fig. 7.10). WUPA 4062 is a gold ring, and WUPA 4078 is a religious metal. Two cut figures were also located (Fig. 7.12 and 7.14). Finally, there were two USFS yellow boundary signs with writing scratched in them: WUPA 4060 and 4081. The writing was probably done by Basque sheep herders working in the area. Often Basques will put names and messages into metal signs when they are passing by (Bassett 1983:27). Prehistoric copper bells (Sprague and Signori 1963:12) were not found during the survey but during the excavation of Wupatki. These trade items are often found in context with shell objects and parrots.

Other Objects

A total of 16 other objects made of wood, minerals, plastic, rubber, paper, fiber, and leather were collected (Table 7.5). All of the wooden objects came from Navajo sites and were related to normal activities associated with these sites. Also associated with the Navajo occupation of Wupatki National Monument was a light blue "trade bead" (Fig. 7.16). It is unknown exactly what material this bead is made of, but it is probably some form of plastic. There were four turquoise objects recovered, all which were pendants or fragments (Figs. 7.17 and 7.18). This mineral was highly prized by prehistoric peoples of the southwestern United States and Mexico, and trade in turquoise was widespread (Ball 1941:25-27; Snow 1973:43-45). One of the better known prehistoric turquoise mines was located at Los Cerrillos, New Mexico. Other mines have been reported in New Mexico, Arizona, Colorado, Nevada, and California (Bartlett 1935:41-42). The turquoise pendants found at Wupatki were probably obtained through trade from elsewhere. Other ornaments located were two argillite pendants, Figs. 7.19 and 7.20). A prehistoric argillite mine was located near Del Rio, Arizona (Bartlett 1939:75-78). The argillite from the Del Rio mines is a dark red color, while the two survey pendants are reddish orange, suggesting that they were from a different source. There are exposures near Tuba City and Tsegi, Arizona, which could have provided this type of argillite (Woodbury 1954:152). These sources would have

TABLE 7.5. Other Objects (Wood, Mineral, Plastic, Rubber, Paper, Fiber, and Leather).

Site Number	Catalogue Number	Length	Width	Thickness	Material	Remarks
WS-22	WUPA 1955	298 mm	26 mm	12 mm	Wood	Homemade tent stake with a notch cut into the side
WS-293	WUPA 2449	159 cm	18.5 cm	--	Wood and metal	Animal herding device with a long wooden handle and metal lashed to it with baling wire
WS-2668	WUPA 2450	840 mm	60 mm	33 mm	Wood and iron	Wooden and handmade iron singletree (used for a horse-drawn wagon)
WS-2668	WUPA 3846	13 mm	13 mm	19 mm	Unknown	Light blue (turquoise color) "trade bead", Hue 5B 7/6, light blue. (see Figure 7.16)
WS-1410	WUPA 3871	11 mm	8 mm	2 mm	Turquoise	Pendant fragment, Hue 5 BG 7/2, pale blue green (see Figure 7.17)
WS-105	WUPA 3869	13 mm	11 mm	5 mm	Turquoise	Pendant fragment, Hue 5 GY 7/2, grayish yellow green
WS-171	WUPA 3870	0.4 mm	0.3 mm	0.2 mm	Turquoise	Fragment only, Hue 5 G 6/6, brilliant green
WS-225	WUPA 2240	13 mm	10 mm	2 mm	Turquoise	Pendant with a small hole in it, Hue 5 G 7/4, light green. (see Figure 7.18)
WS-1905	WUPA 3843	19 mm	13 mm	2 mm	Argillite	Pendant fragment with a hole, Hue 10 R 6/6, moderate reddish orange. (see Figure 7.19)
WS-2405	WUPA 3845	33 mm	23 mm	4 mm	Argillite	Pendant fragment with a hole, Hue 10 R 6/6, moderate reddish orange. (see Figure 7.20)
WS-2274	WUPA 3857	42 mm	16 mm	2 mm	Plastic	Toy "Cracker-Jack boy" from a historic trash dump (A)
WS-1287	WUPA 4058	80 mm	53 mm	3 mm	Rubber and paper	Orange balloon with a tag
WS-1603	WUPA 2432	Height: 260 mm	Diameter: 490 mm	9 mm	Fiber-reeds, grass, and feathers	Large prehistoric basket with a 3 rod foundation and a checkered diamond design, Hue 10 YR 8/2 (see Figure 7.21)
WS-25	WUPA 4057	21 mm	10 mm	10 mm	Cotton rope	Horse halter, green and white
WS-1949	WUPA 3872	60 mm	1.3 mm	0.4 mm	Leather	Strap fragment with a button hole and seam holes, black
WS-1940	WUPA 2434	11 in	8.5 in	--	Paper	Mine claim form found in a can in a rock cairn on Doney Mountain, ivory (see (Figure 7.22)

also been much closer then the Del Rio mines, which are 75 miles from Wupatki (Bartlett 1939:78). WUPA 3845 is very similar in shape to a red shale pendant found at Pueblo Bonito (Jernigan 1978:191).

Two children's toys were found: a plastic "cracker-jack boy" and a orange balloon with a paper tag. Often children's toys found in association with Navajo sites are small objects lost or discarded intact, as if such

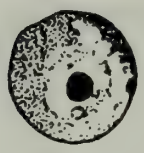


FIGURE 7.16. WUPA 3846, Trade Bead.

FIGURE 7.17. WUPA 3871, Pendant Fragment

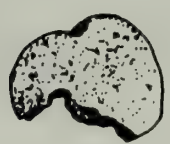


FIGURE 7.18. WUPA 2240, Pendant.

FIGURE 7.19. WUPA 3843, Pendant Fragment.

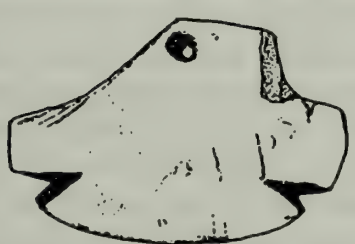
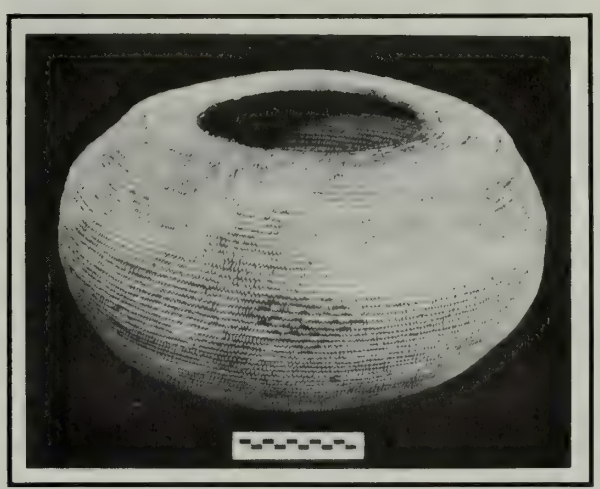


FIGURE 7.20. WUPA 3845, Pendant Fragment.

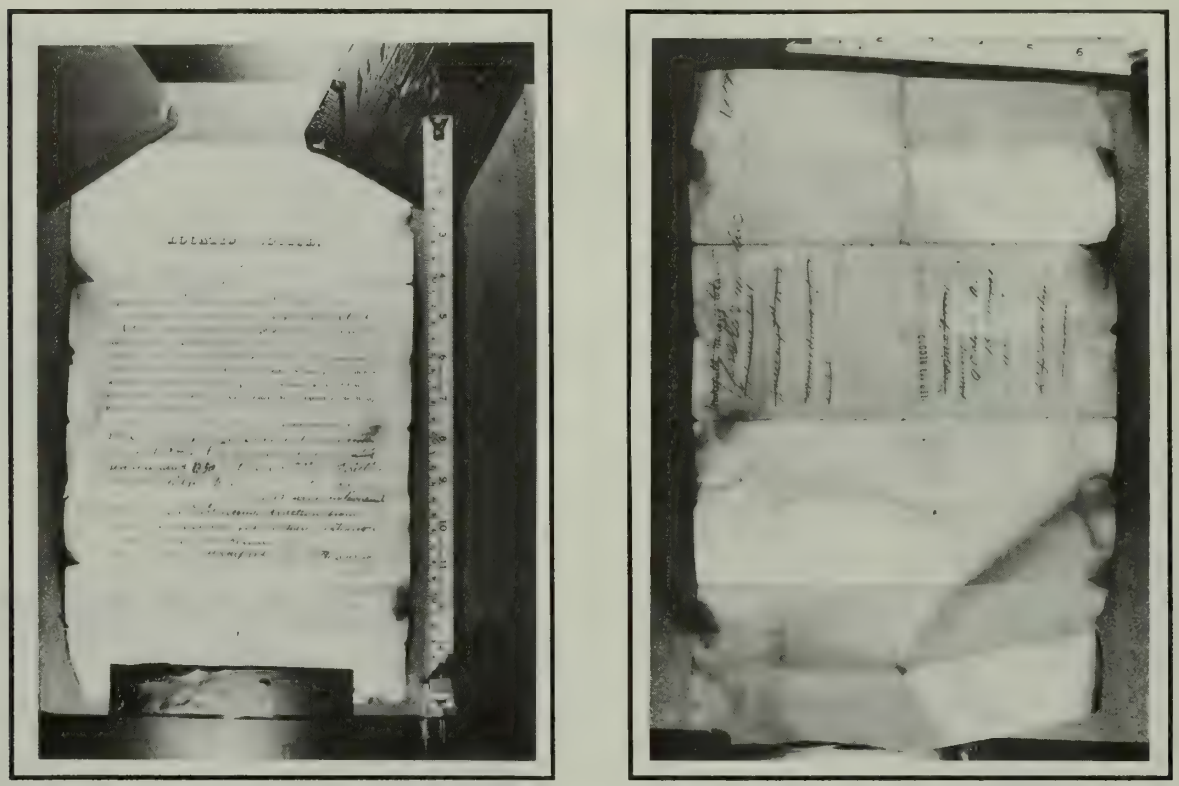
In Situ



After Cleaning

FIGURE 7.21. WUPA 2432, Prehistoric Basket with a 3-rod foundation. Height: 260 mm; Greatest Diameter: 49.5 cm.; Diameter of Opening: 98 mm.; Average Design Length: 66 mm. (vertical); Average Design Width: 90 mm. (horizontal); Width of Basketry: 9 mm.; Color: Hue 10 YR 8/2 to Hue 10 YR 2/2.

toys were not part of the usual routine of Navajo life children on the reservation (Ward et al. 1977:271). Other toys included 3 marbles, a ceramic figurine, a toy truck, a toy car, a wheel from a toy wagon, and two cut tin figures (Tables 7.3 and 7.4). All told, there were very few toys found at the many



Front Back

FIGURE 7.22. Mining Claim from WS-1940. This legal-sized form was found inside a square tin can with a screw top

Navajo sites recorded during the survey process.

The most significant item recovered during the survey was a prehistoric basket (Fig. 7.21). This perishable, fragile artifact, found at WS-1603, had gone unnoticed for approximately 800 years because of its positioning in a dry, protected environment (an earth crack). The construction is coiled with three bunched rods and fine stitching, and the form is a large, broad, globular shape like a "seed jar" (Whiteford 1986:personal communication). There are design elements of checkered diamonds at four intervals around the widest part of the body, which may have been made of splits of devil's claw. The rods are probably of Apache plume, and the design elements (black-colored materials) are feathers (Minnis 1986:personal communication). This archeological item is very important because (1) a definite association with the prehistoric people and the unique geological features can now be demonstrated; (2) due to the perishable nature of large fiber baskets, finding a complete intact specimen is extremely rare; (3) the fact that it was located in it's original provenience and the context is unique; and (4) the total inventory of Pueblo III baskets for the greater Southwest is limited. Other nearby sites where similar baskets have been found include Chaves Pass (Weltfish 1932:26), Ridge Ruin (McGregor 1943:273-278), and Medicine Cave (Bartlett 1934:44-45). At Mesa Verde, similar coiled baskets with similar bird-quill checkered designs have been

described (Morris and Burgh 1941:40, Fig. 18e).

The last three items are made of rope, leather, and paper. WUPA 4057 is a green and white horse halter. WUPA 3872, a leather strap fragment, may also have been equestrian tack. Finally, WUPA 2434 is a paper mine claim form (Fig. 7.22). On the back of the form it states that the form was "filed and recorded at the request of" Benjamin Doney, January 2, 1883. The front, however, indicates that the claim was for the Wakefield Mining Company, which was crossed out in pencil, and the name Foster penciled in). Another claim form was also found on the east side of Doney Mountain by Harold S. Colton. This one was dated January 1, 1903, for B. Doney (Museum of Northern Arizona Collections). It is called "The Lost Padre Mining Claim," which refers to a Spanish legend about mercury ore (Colton 1940:17-22). The form found on survey (WUPA 2434) refers to gold and silver lodes. It does not appear that Ben Doney was very successful at obtaining any type of ore, other than red volcanic cinders.

Ground, Smoothed, and Flaked Stone

There were 97 artifacts collected that fall within this category (Table 7.6). The bulk of these objects were manos, metates, hoes, basalt cylinders, plugs, and axes or mauls. Of the 30 manos collected, only 4 were one-hand manos. One-hand manos are not common at sites in the Flagstaff area (Colton 1946:286). Eleven of the manos were of sandstone or a similar course material; the rest were all basalt. Larger two-hand manos required more preparation in shaping them for use (Eddy 1964:5). WUPA 4118, a two-hand basalt mano, was found at WS-1326 (Fig. 7.28). WUPA 4112, a two-hand sandstone mano, was found at WS-1206 (Fig. 7.29). Wupa 4163, a circular vesicular basalt grinding stone, was collected at WS-2021 (Fig. 7.34). WUPA 4169, a quartzite one-hand mano, came from WS 2384 (Fig. 7.35). WUPA 4156, a large two-handed basalt mano, was collected from WS 1884 (Fig. 7.36). WUPA 4174, a large two-hand basalt mano with finger grooves, was from WS 2637 (Fig. 7.37). Manos grooved with finger grips are found at Pueblo II and III sites (Bartlett 1930:3). Manos with have these grooves are generally rather thick, ranging from 3 to 9 cm (Bartlett 1933:11). Two-hand manos are most often utilized on only one side, except in rare cases (Bartlett 1934:27). Five complete and four metate fragments were collected. Of the complete specimens, 3 were trough types and 2 were slab types; and 3 were basalt and 2 were sandstone. By A.D. 1100, the slab metate gradually replaced the trough form for increased use in a metate bin (Eddy 1964:9). Several metates could be permanently set up in bins, with varied grades of courseness, which would allow finer grinding. This allowed for several women to work together at the same time and enjoy each other's company (Bartlett 1933:29). WUPA 4177, a sandstone trough metate, was collected from WS-2381 (Fig. 7.38). WUPA 4178, a vesicular basalt trough metate, came from WS 2612 (Fig. 7.39). One large basalt metate in Antelope Canyon was so heavy that two people could barely lift it. This may have been the overriding factor in limiting the number of specimens collected during the inventory survey process. Occasionally both manos and metates are found at Navajo sites, and probably these were "re-used" from the prehistoric ruins (Ward et al. 1977:246).

Hoes also comprise a large part of the inventory of the ground and flaked stone. A

TABLE 7.6. Ground, Flaked, and Smoothed Stone.

Site Number	Catalogue Number	Length	Width	Thickness	Material	Color	Remarks
WS-665	WUPA 4099	275 mm	128 mm	10 mm	Basalt	Hue 5 YR 5/1, moderate brownish gray	Fine-grained basalt hoe - flaked around all edges.
WS-418	WUPA 4094	160 mm	110 mm	50 mm	Basalt	Hue N 4, medium dark gray	1/2 of rounded basalt fragment - smoothed on both faces - use unknown.
WS-951	WUPA 4106	146 mm	83 mm	19 mm	Sandstone	Hue 10 R 5/4, pale reddish brown	Possible shaft smoother, but be natural.
WS-224	WUPA 2239	173 mm	105 mm	13 mm	Slate	Hue N 3, dark gray	Black smoothed hoe - polish all edges - complete.
WS-896	WUPA 4105	73 mm	41 mm	10 mm	Slate	Hue N 4, medium dark gray	Fragment - may have been part of a hoe - smooth on edge.
WS-851	WUPA 4102	108 mm	71 mm	43 mm	Basalt	Hue N 5, medium gray	Fine-grained 3/4 grooved axe - bit is broken. (see Figure 7.23)
WS-751	WUPA 4101	19 mm	18 mm	14 mm	Unknown	Hue 5 R 8/2, grayish pink	Concretion? Mineral?
WS-376	WUPA 4093	185 mm	94 mm	32 mm	Basalt	Hue N 4, medium dark gray	Complete vesicular basalt 2-hand mano.
WS-274	WUPA 4088	202 mm	101 mm	60 mm	Basalt	Hue N 3, dark gray	Vesicular basalt 2-hand mano with grooved edges - 1 face smoothed.
WS-268	WUPA 2301	147 mm	114 mm	10 mm	Slate	Hue N 4, medium dark gray	Smoothed and flaked hoe - 1 face smooth and other rough - complete.
WS-500	WUPA 4096	149 mm	94 mm	14 mm	Slate	Hue N 4, medium dark gray	Natural fragment, probably used as a hoe - smoothed along the edge.
WS-275	WUPA 4089	80 mm	35 mm	29 mm	Basalt	Hue N 4, medium dark gray	Vesicular basalt cylinder (see Figure 7.24)
WS-	WUPA 4085	144 mm	107 mm	35 mm	Conglom-erate	Hue 10 YR 6/4, gray yellowish brown	3/4 of a 2-hand mano - yellow/brown in color - 1 worked face.
WS-I.O. Sec. 12, T.25N, R.10E	WUPA 4086	295 mm	119 mm	12 mm	Sandstone	Hue 5 R 6/2, pale red	2 sandstone hoe fragments? which fit together - rough slab with some flaking around the edges.
WS-615	WUPA 4098	168 mm	115 mm	12 mm	Slate	Hue N 5, medium gray	Natural fragment, probably used as a hoe.
WS-281	WUPA 4090	123 mm	129 mm	14 mm	Sandstone	Hue 10 R 5/4, moderate pinkish brown	1/2 of a hoe fragment - flaking around edge.
WS-446	WUPA 4095	178 mm	114 mm	12 mm	Slate	Hue N 5, medium gray	Complete hoe - natural, unworked.
WS-860	WUPA 4103	202 mm	105 mm	45 mm	Basalt	Hue N 3, dark gray	Vesicular, 2-handed mano - 1 smoothed face with 1 finger groove.

TABLE 7.6. (continued).

Site Number	Catalogue Number	Length	Width	Thickness	Material	Color	Remarks
WS-272	WUPA 4087	193 mm	122 mm	0.7 mm	Sandstone	Hue 10 YR 6/4, gray yellowish brown	Complete hoe with flaking and smoothing around the edges.
WS-596	WUPA 4097	254 mm	111 mm	30.5 mm	Sandstone	Hue 5 YR 6/2, grayish pink brown	2-hand mano - smoothed on one face.
WS-357	WUPA 4091	232 mm	125 mm	11 mm	Sandstone	Hue 10 YR 6/4, gray yellowish brown	Complete hoe - natural slab - tear drop shape.
WS-892	WUPA 4104	48 mm	37 mm	38 mm	Basalt	Hue N 4, medium dark gray	Vesicular basalt plug - volcanic bomb which may have been a jar stopper. (see Figure 7.25)
WS-364	WUPA 4092	229 mm	155 mm	0.9 mm	Sandstone	Hue 5 YR 3.5/4, moderate brown	Complete hoe - flaking around the edge - rectangular shape.
WS-1361	WUPA 4123	70.3 mm	60.4 mm	31.4 mm	Basalt	Hue N 4, medium dark gray	Vesicular basalt piece with a groove - may be an effigy of some sort. (see Figure 7.26)
WS-1466	WUPA 4128	80.1 mm	40.4 mm	20.3 mm	Basalt	Hue N 5, medium gray	Corner fragment of basalt porphory metate.
WS-1112	WUPA 4110	288 mm	170 mm	14 mm	Sandstone	Hue 5 R 5/2, pale grayish red	Complete hoe - teardrop shape with some flaking along the edge.
WS-1265	WUPA 4116	204 mm	97 mm	10.2 mm	Slate	Hue N 4, medium dark gray	Complete hoe - smoothed on all edges and both faces.
WS-1243	WUPA 4115	189 mm	107 mm	14 mm	Slate	Hue N 4, medium dark gray	Natural piece used as a hoe - smoothed on both faces and edges.
WS-1630	WUPA 4131	50.2 mm	29 mm	20.5 mm	Sandstone	Hue 10 R 5/4, pale reddish brown	Mano fragment.
WS-1771	WUPA 4132	68 mm	68 mm	41 mm	Basalt	Hue 10 R 5/2, pale grayish red	Corner of a metate - fragment.
WS-1467	WUPA 4129	88 mm	70 mm	57 mm	Basalt	Hue 5 R 4/2, grayish red	Smoothed on 1 face - vesicular basalt - use unknown.
WS-1035	WUPA 4108	100.5 mm	100.5 mm	10.6 mm	Sandstone	Hue 10 R 5/4, pale reddish brown	Disk with a hole in center (9 mm diameter) - made from a natural slab. (see Figure 7.27)
WS-1395	WUPA 4124	70.1 mm	20.5 mm	20.3 mm	Basalt	Hue N 4, medium dark gray	Vesicular basalt cylinder.
WS-1432	WUPA 4126	10.6 mm	10.6 mm	10 mm	Opal?	Hue 10 R 7/4, moderate orange pink	Use unknown - smoothed?
WS-1432	WUPA 4127	60.5 mm	24 mm	11 mm	Basalt	Hue N 4, medium dark gray	Vesicular basalt cylinder.
WS-1400	WUPA 4125	55 mm	51 mm	30 mm	Basalt	Hue N 4, medium dark gray	Vesicular basalt metate fragment.
WS-1356	WUPA 4122	60 mm	56 mm	12 mm	Quartzite	Hue N 7, light gray	Smooth on 1 face - may be a mano fragment - square shape.

TABLE 7.6. (continued).

Site Number	Catalogue Number	Length	Width	Thickness	Material	Color	Remarks
WS-1365	WUPA 4121	52 mm	45 mm	37 mm	Unknown	Hue 10 YR 6/2, pale yellowish brown	Cobble - smooth and rounded - may be a pottery polishing stone.
WS-1096	WUPA 4109	55 mm	50 mm	23 mm	Basalt	Hue N 4, medium dark gray	Fine-grained fragment - smooth on edge - use unknown.
WS-1206	WUPA 4113	184 mm	75 mm	80 mm	Basalt	Hue N 4, medium dark gray	Complete vesicular basalt 2-handed mano - 1 worked face with finger grooves down edges.
WS-1509	WUPA 4130	260 mm	114 mm	71 mm	Basalt	Hue N 4, medium dark gray	"Bread loaf" 2-handed vesicular basalt mano with finger grooves - worked on all faces.
WS-1326	WUPA 4119	257 mm	110 mm	36 mm	Sandstone	Hue 10 R 6/2, pale red	Complete 2-handed mano - worked on both faces.
WS-1326	WUPA 4120	161 mm	97 mm	47 mm	Scoria	Hue N 3, dark gray	Very light porous 1-handed mano
WS-1326	WUPA 4118	234 mm	106 mm	45 mm	Basalt	Hue N 4, medium dark gray	Complete 2-handed mano - worked on both faces. (see Figure 7.28)
WS-1206	WUPA 4112	266 mm	107 mm	45 mm	Sandstone	Hue 10 R 5/4, pale reddish brown	Split along length (2 pieces) - complete 2-handed mano with one worked face. (see Figure 7.29)
WS-1238	WUPA 4114	228 mm	108 mm	12 mm	Slate	Hue N 4, medium dark gray	Complete hoe - smooth on both faces and edges. (see Figure 7.30)
WS-1301	WUPA 4117	256 mm	105 mm	18 mm	Basalt	Hue N 4, medium dark gray	Fine-grained hoe complete - flaked on all edges. (see Figure 7.31)
WS-1206	WUPA 4111	197 mm	100.7 mm	56 mm	Basalt	Hue N 4, medium dark gray	Complete vesicular basalt 2-handed mano - one worked face with finger grooves down edges.
WS-1937	WUPA 4136	213 mm	128 mm	9 mm	Sandstone	Hue 10 R 4/4, reddish brown	Hoe (3 fragments) - complete.
WS-2000	WUPA 4145	260 mm	148 mm	8 mm	Sandstone	Hue 10 R 5/2, pale grayish red	10 fragments to fit together to form portions of 3 sandstone hoes.
WS-2000	WUPA 4146	60 mm	47 mm	60 mm	Basalt	Hue N 3, dark gray	Round cobble - may be water worn - used as a hammerstone?
WS-2015	WUPA 4148	243 mm	126 mm	14 mm	Sandstone	Hue 10 R 5/4, pale reddish brown	3 fragments of an almost complete sandstone hoe.
WS-1897	WUPA 4134	75 mm	130 mm	0.8 mm	Slate	Hue N 4, medium dark gray	Hoe fragments (3) - about about 1/2 of a hoe - smooth on both faces and edge.
WS-2002	WUPA 4149	100.7 mm	60.5 mm	60.6 mm	Basalt	Hue N 3, dark gray	Rounded vesicular basalt stone - use unknown.

TABLE 7.6. (continued).

Site Number	Catalogue Number	Length	Width	Thickness	Material	Color	Remarks
WS-2360	WUPA 4155	79 mm	30.4 mm	25 mm	Basalt	Hue 5 R 4/2, grayish red	Vesicular basalt cylinder.
WS-2321	WUPA 4154	90 mm	76 mm	28 mm	Basalt	Hue N 3, dark gray	Vesicular basalt stone bowl or mortar. (see Figure 7.32)
WS-1998	WUPA 4144	80.6 mm	82 mm	50 mm	Basalt	Hue N 3, dark gray	Metate fragment.
WS-1964	WUPA 4138	240.8 mm	175 mm	1.9 mm	Sandstone	Hue 10 R 5/4, pale reddish brown	7 fragments (all part of same hoe, but not complete).
WS-1975	WUPA 4141	225 mm	98 mm	15 mm	Sandstone	Hue 10 R 6/2, pale yellowish brown	8 fragments to form a complete hoe.
WS-2001	WUPA 4147	34 mm	25 mm	26 mm	Basalt	Hue N 3, dark gray	1/2 of a vesicular basalt cylinder.
WS-1965	WUPA 4139	246 mm	120 mm	12 mm	Sandstone	Hue 10 YR 6/2, pale yellowish brown	6 fragments which fit together to make a complete hoe.
WS-2029	WUPA 4151	185 mm	146 mm	12 mm	Slate	Hue N 4, medium dark gray	Almost complete hoe - end broken off - flaking around the edge with smoothed faces.
WS-1996	WUPA 4143	267 mm	160 mm	0.7 mm	Sandstone	Hue 10 YR 6/2, pale yellowish brown	22 fragments to form a complete sandstone hoe - teardrop shape.
WS-2231	WUPA 4152	261 mm	143 mm	9 mm	Sandstone	Hue 5 R 5/2, grayish pale red	Complete hoe (2 pieces) - teardrop shaped.
WS-1961	WUPA 4137	249 mm	131 mm	20 mm	Sandstone	Hue 10 R 5/4, pale reddish brown	Natural slab, probably used as a hoe.
WS-1993	WUPA 4142	212 mm	159 mm	8 mm	Sandstone	Hue 5 YR 6/1, light brownish gray	5 fragments to form a nearly complete sandstone hoe.
WS-1973	WUPA 4140	182 mm	97 mm	6 mm	Sandstone	Hue 5 YR 6/4, light brown	12 fragments of a sandstone hoe (not complete).
WS-2012	WUPA 4150	85 mm	88 mm	10.5 mm	Slate	Hue N 6, medium light gray	Flaked along edge - ca. 1/4 of a hoe.
WS-1881	WUPA 4133	237 mm	150 mm	10 mm	Sandstone	Hue 5 R 6/2, pale red	Complete hoe - flaked around edges - teardrop shape. (see Figure 7.33)
WS-1909	WUPA 4135	232 mm	153 mm	6 mm	Sandstone	Hue 10 YR 5/4, moderate yellowish brown	Hoe - complete - teardrop shape and flaked around edges.
WS-2296	WUPA 4153	245 mm	197 mm	10 mm	Sandstone	Hue 10 YR 6/4, grayish yellow	Natural slab - may have been used as a cover - may have some flaking.
WS-2021	WUPA 4163	89 mm	89 mm	30 mm	Basalt	Hue N 4, medium dark gray	Circular vesicular basalt grinding stone - smoothed on both faces. (see Figure 7.34)
WS-2042	WUPA 4164	70 mm	62 mm	58 mm	Basalt	Hue N 2, grayish black	"Plug" - worked on all faces - cylinder?

TABLE 7.6. (continued).

Site Number	Catalogue Number	Length	Width	Thickness	Material	Color	Remarks
WS-2170	WUPA 4166	190 mm	109 mm	45 mm	Basalt	Hue N 4, medium dark gray	Complete vesicular basalt mano - worked on both faces.
WS-1998	WUPA 4159	218 mm	98 mm	30 mm	Sandstone	Hue 10R 5/2, grayish pale red	Complete mano - 2-handed, 1 face - in two pieces.
WS-2384	WUPA 4169	111 mm	83 mm	27 mm	Quartzite	Hue 5 R 6/2, pale red	Complete mano, 1-handed, worked on 1 face with smoothing around the edges. (see Figure 7.35)
WS-2019	WUPA 4162	118 mm	97 mm	22 mm	Basalt	Hue N 4, medium dark gray	Ca. 1/2 of a 2-handed mano - worked on 1 face.
WS-2381	WUPA 4167	190 mm	101 mm	45 mm	Basalt Porphory	Hue N 5, medium gray	Complete mano - worked on both faces, 2-handed.
WS-1900	WUPA 4158	184 mm	90 mm	34 mm	Basalt	Hue N 4, medium dark gray	Complete (thin) 2-handed mano - 1 worked face.
WS-1900	WUPA 4157	226 mm	107 mm	62 mm	Basalt	Hue N 4, medium dark gray	Complete vesicular basalt 2-handed mano with finger grooves along edge - 1 face.
WS-1884	WUPA 4156	214 mm	111 mm	104 mm	Basalt	Hue N 4, medium dark gray	"Bread loaf" - 2-handed mano - worked on all faces. (see Figure 7.36)
WS-2381	WUPA 4168	199 mm	94 mm	68 mm	Basalt	Hue N 4, medium dark gray	Complete 2-handed, 1-faced vesicular basalt mano.
WS-2015	WUPA 4161	206 mm	108 mm	56 mm	Basalt	Hue N 4, medium dark gray	Almost complete vesicular basalt mano - 2-handed with finger groove - 1 worked face.
WS-2131	WUPA 4165	222 mm	107 mm	20 mm	Sandstone	Hue 10 R 5.5/4, pale reddish brown	Complete 2-handed mano, worked on 1 face.
WS-2445	WUPA 4171	63 mm	30 mm	21 mm	Basalt	Hue N 4, medium dark gray	Complete vesicular basalt cylinder.
WS-2560	WUPA 4172	197 mm	110 mm	65 mm	Basalt	Hue 5 R 4/2, grayish red	Complete vesicular basalt mano - 2-handed, worked on one face.
WS-2637	WUPA 4174	268 mm	113 mm	100 mm	Basalt	Hue 10 R 5/4, pale reddish brown	"Bread loaf" - complete 2-handed, worked on 1 face mano with finger grooves - vesicular basalt. (see Figure 7.37)
WS-2522	WUPA 4170	117 mm	80 mm	20 mm	Basalt	Hue 5 Y 4/1, olive gray	Fine-grained 1-handed mano, smoothed on 1 face, complete.
WS-2567	WUPA 4173	224 mm	106 mm	69 mm	Sandstone	Hue 10 R 5/4, pale reddish brown	Complete 2-handed mano with finger grooves, smoothed only on 1 face.
WS-704	WUPA 4100	91 mm	46 mm	14 mm	Sandstone	Hue 5 YR 7/4, light orange brown	Smoothed cobble, 1/2, may have been utilized as a pot-lid.
WS-603	WUPA 4107	172 mm	80 mm	8 mm	Sandstone	Hue 10 R 5/4, pale reddish brown	Broken (2 pieces), small hoe, complete with smoothing around the edges.

TABLE 7.6. (concluded).

Site Number	Catalogue Number	Length	Width	Thickness	Material	Color	Remarks
WS-615	WUPA 4170	38.5 cm	31 cm	18.5 cm	Basalt	Hue 5 Y 4/1, olive gray	Vesicular basalt slab metate.
WS-2028	WUPA 4175	43 cm	29.5 cm	8 cm	Sandstone	Hue 10 R 5.5/3, pale reddish brown	Slab metate.
WS-2239	WUPA 4176	36.5 cm	34.5 cm	11.5 cm	Basalt	Hue N 5, medium gray	Trough metate, vesicular basalt.
WS-2381	WUPA 4177	49 cm	30 cm	9.5 cm	Sandstone	Hue 10 R 6/4, pale reddish brown	Trough metate, wedge-shaped. (see Figure 7.38)
WS-2612	WUPA 4178	44.5 cm	31.5 cm	12 cm	Basalt	Hue N 7, light gray	Vesicular basalt trough metate. (see Figure 7.39)
WS-1107	WUPA 4160	54 mm	52 mm	23 mm	Basalt	Hue N 4, medium dark gray	Fine-grained, grooved axe or maul fragment. (see Figure 7.40)

total of 37 fragmentary and complete hoes were collected during the survey (Table 7.6). Two materials were utilized for the manufacture of hoes: slate and sandstone. These unique artifacts were formed by both flaking and smoothing natural slabs into the desired shape (generally a "tear-drop" form). WUPA 4114, a complete slate hoe, was smoothed on both faces and the edges (Fig. 7.30). WUPA 4117 was a complete basalt (or slate?) hoe flaked on all edges (Fig. 7.31). WUPA 4133 was a complete sandstone hoe flaked around the edges (Fig. 7.33). Certainly the number of hoes collected and observed further emphasizes the importance of agricutural production prehistorically at Wupatki. Most of the hoes collected come from the field areas, although a few are associated with habitation sites (Colton 1946a:286-287). These hand hoes were probably utilized to scrape the cinders away so the subsoil could be exposed for planting with a digging stick (Bartlett 1934:23-24). This type of artifact is generally not found in preeruptive sites or outside of the ash fall area.

A third major category in this section is comprised of cylinders and plugs (Table 7.6). Eight of these unusual artifacts were collected during the survey process. These cylindrical vesicular basalt stones are very common at Pueblo II and Pueblo III sites in the Flagstaff area (Bartlett 1934:26). There have been no cylinders found at sites dating earlier than A.D. 1070 (Colton 1946a:288). A basalt cylinder from WS 275 is illustrated in Figure 7.24. The purpose for these objects is unknown, but, they may have been used as runners tokens in relay races (Bartlett 1934:26), or they may have been

TABLE 7.7. Axes and Mauls: Additional Measurements.

Catalogue Number	Length (mm)	Width (mm)	Thickness (mm)	Poll Length (mm)	Face Length (mm)	Bit Width (mm)	Weight (gm)
WUPA 4102	108	71	43	42	48	53	519.7
WUPA 4160	54	52	23	41	--	--	88.4

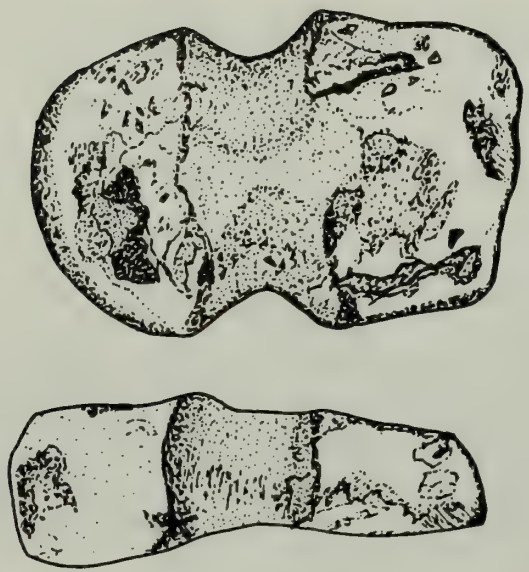


FIGURE 7.23. WUPA 4102, 3/4 Grooved Axe.

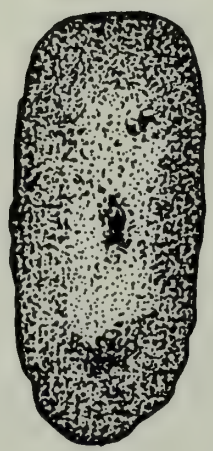


FIGURE 7.24. WUPA 4089, Basal t Cylinder.

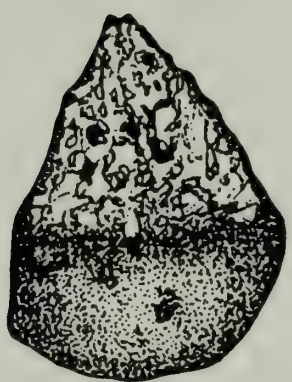


FIGURE 7.25. WUPA 4104, Basalt Plug.

FIGURE 7.26. WUPA 4123, Basalt Effigy.

FIGURE 7.27. WUPA 4108, Sandstone Disk.

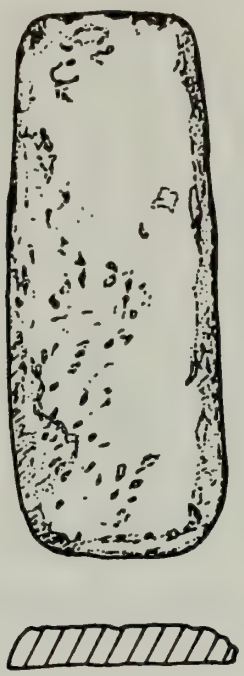


FIGURE 7.29. WUPA 4112, 2-Handed Mano.

FIGURE 7.28. WUPA 4118, 2-Handed Mano.

FIGURE 7.30. WUPA 4114, Complete Hoe.

FIGURE 7.31. WUPA 4117, Complete Hoe.

FIGURE 7.33. WUPA 4133, Complete Hoe.

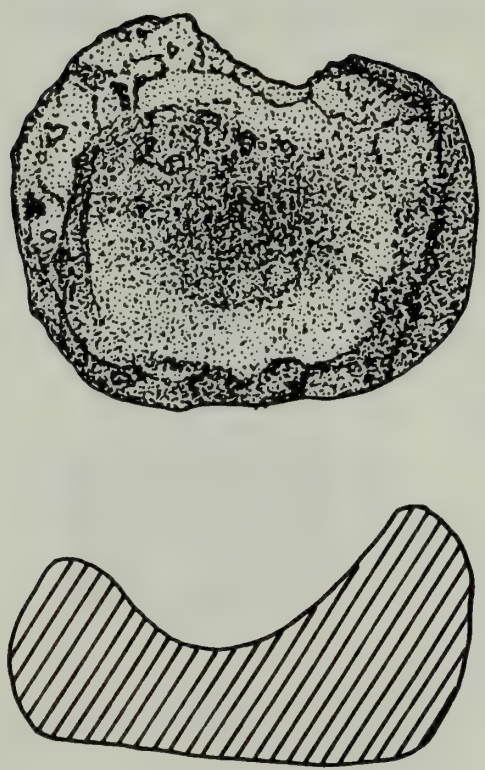


FIGURE 7.32. WUPA 4154, Basalt Stone Bowl

FIGURE 7.34. WUPA 4163, Basalt Grinding Stone.

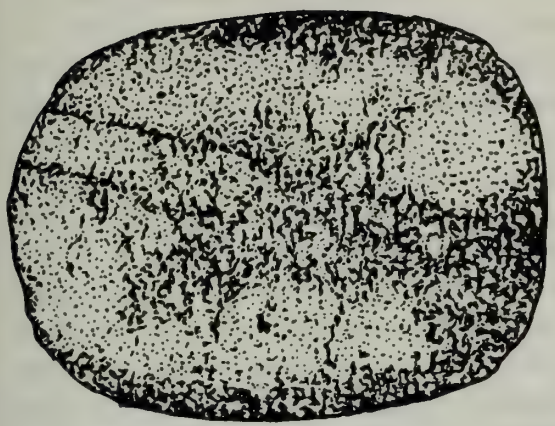


FIGURE 7.35. WUPA 4169, Complete Mano.

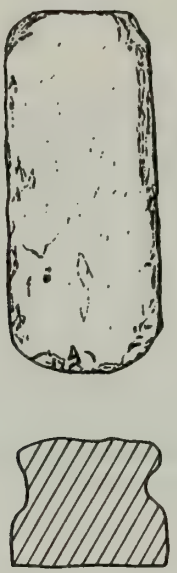


FIGURE 7.37. WUPA 4174, Basalt Mano.

FIGURE 7.36. WUPA 4156, Basalt Mano.

FIGURE 7.38. WUPA 4177, Trough Metate.

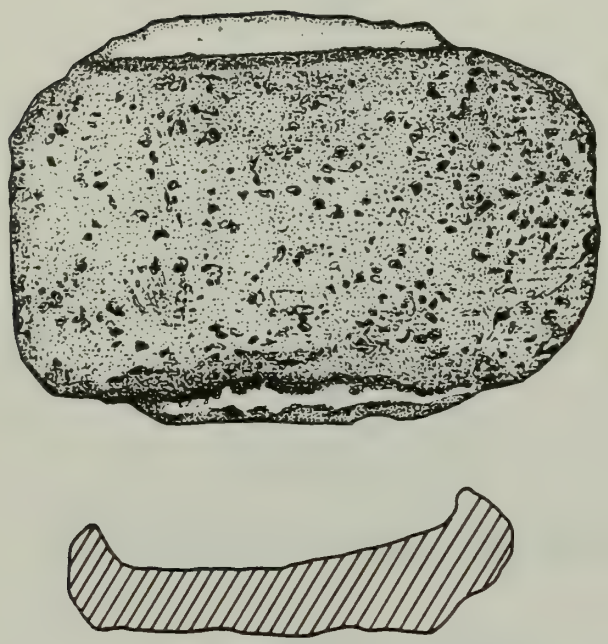


FIGURE 7.39. WUPA 4178, Trough Metate.

FIGURE 7.40. WUPA 4160, Grooved Axe or Maul Fragment.

shelling corn (Colton 1946:288-290). A vesicular basal plug was collected at WS 892 (Fig. 7.25). It may have been used as a jar stopper or a pottery anvil. Anvils are not common for Sinaqua sites, but are generally found after A.d. 1100 (Colton 1946:288).

Two fine-grained grooved axes or mauls were collected from sites WS 851 and WS 1107 (Tables 7.6 and 7.7 and Figs. 7.23 and 7.40). Axes are defined as tools utilized for chopping and working wood. Mauls are grooved implements, basically unmodified except for the groove (Breternitz 1976:1-2, 21-24). It is suggested that the limited frequency of these tools at Chaco Canyon may have been a factor of limited timber resources. This may have been a limiting factor also for Wupatki. Both full-grooved and 3/4-grooved axes and mauls are found in the Flagstaff area. The full-grooved maul seems to be a distinctive trait of the Pueblo pattern (Reed 1951:46). Mauls could have been used for pounding, splitting, and crushing wood or extracting marrow from bones (Bartlett 1934:31). Quite possibly, mauls were reused axes or unmodified axes, and possibly they should be called "hammers" (Woodbury 1954:40-49). Three-quarter grooved axes gradually spread northward, where full-grooved axes were already in use, without ever replacing them (Woodbury 1954:31). Axes with a 3/4 groove occur from Pueblo II time on (Bartlett 1930:3).

The remaining flaked and ground stone objects include a shaft smoother, a grooved basalt piece (Fig. 7.26), a sandstone disk, (Fig. 7.27) a possible polishing stone, a hammerstone, a basalt bowl or mortar, (Fig. 7.32) and sandstone slab covers (Table 7.6). Some objects of unknown function also occur in the collection. Many natural cobbles and stones were probably also utilized for varying functions, but they were not recognized as artifacts.

Flaked Lithic Artifacts

Along with other cultural materials, flaked lithic artifacts were collected from approximately 400 hundred (15%) sites. During October 1987, Nickens and Associates, Montrose, Colorado,contracted with the National Park Service (NPS) to conduct an analysis of the flaked lithic ar-

tifacts. This portion of the chapter documents the results of that analysis.

Objectives of the Study

The research objectives of this study are essentially fourfold. First, this study will attempt to provide basic descriptive data on the analyzed artifact assemblage. Attention will focus on a description of raw material types and artifact classes. Second, where the collected assemblage and the following analyses allow, the lithic technological behavior of the Wupatki Basin residents will be interpreted. These interpretations will extensively utilize the analysis of lithic debitage, which comprises about 70% of the assemblage. Third, projectile points included in the analysis will be placed into classes based largely on morphology and hafting element attributes. The occurrence of these point types at archaeological sites in which the period of occupation has been postulated will also be examined in an attempt to more fully elucidate the temporal range of specific point types. Finally, some general and specific research questions generated by the above analyses will be suggested. Because contract requirements place strict limits on the length of this report, the description, analysis, and interpretations presented here will be succinct.

The Nature of the Data

The analyzed artifact assemblage consists of 3,304 lithic specimens, including projectile points, bifaces, specialized bifaces such as drills and gravers, unifaces, utilized flakes, cores, and raw material specimens.

Briefly, limited collections of artifacts and raw lithic material specimens were made in 1981 and 1982; collections made after that time were generally limited to artifacts believed to be in danger of collection by relic collectors.

The sites from which artifacts were collected date largely to the Pueblo II and Pueblo III periods and, to a lesser degree, to the Navajo occupation period. There are also several sites of unknown cultural affiliation (Anderson 1982, 1983, 1984, 1986, 1987; Anderson and Mckenna 1985). While earlier sites probably exist in the region and in fact are tentatively suggested by this analysis, the existing literature suggests such sites are far from common (Hartman and Wolf 1977:15; Gumerman and Skinner 1968; Anderson 1982, 1983, 1984, 1986, 1987).

Analytic Methods

Prior to their shipment, all artifacts were washed, bagged, and accessioned. Many of the formal tools were also labeled. Before beginning the analysis, catalogues for the various artifact types were prepared, including catalogues for projectile points, specialized bifaces (knives, drills, etc.), bifaces, unifaces, utilized and retouched flakes, cores, and debitage. Specific attribute data emphasized a variety of morphological and technological characteristics.

All items included in the lithic artifact collection were macroscopically inspected for evidence of cultural modification and/or intentional use, then items exhibiting this evidence were classified, and relevant morphological and technological data were obtained. While all items, including debitage, were macroscopically inspected for evidence of edge damage, detailed use-wear studies such as those exemplified in Hayden (1978) were considered to be beyond the scope of the analysis.

In order to more fully study the lithic technology reflected in the assemblage, a systematic analysis of the 2,339 pieces of debitage following a classification procedure described by Sullivan and Rozen (1985) was conducted. Data from this analysis were then encoded for computer-assisted analyses and entered on a KAYPRO PC-10 computer utilizing Dbase III and an SPSS-PC (Statistical Package for the Social Sciences) software program for further statistical analyses. Because other artifact categories consisted of significantly fewer items, computer-assisted analyses were not warranted for them.

Both the raw lithic material types and broad artifact classes comprising the lithic collection are described and discussed, including a descriptive but succinct morphological description of projectile point types. The results of the debitage analysis, which comprise the majority of the flaked lithic artifact collection, are then used to draw technological inferences regarding past cultural behavior in the Wupatiki area.

Raw Material Types in the Wupatki Collection

The geologic history of the Monument has significantly influenced its human occupation (Hartman and Wolf 1977:3). The deposition and formation of sedimentary rocks, eruption of igneous rocks primarily through flow deposits, and alluvial downcutting and redeposition by the Little Colorado River provided the prehistoric residents of the Wupatiki region with a wide variety of suitable toolstone, including cherts, agates, chalcedony, silicified woods, basalt, and others.

The flaked lithic artifacts and raw material specimens collected during the archaeological surveys of Wupatki National Monument are comprised of a diverse array of lithic materials and are roughly reflective of the geologic history of the Monument. Surveys (Anderson 1981, 1983) along the eastern edge of the Monument suggest that many of these materials were available within old terrace deposists of the Little Colorado River. Obsidian, which is not known to occur in the area, was probably procured primarily from sources located near the San Francisco Mountains (Jack 1971) to the west and through exchange with neighboring groups to the north and east.

Fourteen somewhat distinct but occasionally overlapping raw material types were macroscopically identified during the analysis; for the final analysis some types were merged (Table 7.8). The material types are presented primarily as basic descriptive data; correlation of archaeological specimens to specific geologic sources located either within or outside of the Wupatki region would be an excellent future research topic. Petrographic analysis and chemical characterization, both essential aspects to accurate identification of many lithic materials at Wupatki, were considered beyond the scope of this project.

Cherts are a cryptocrystalline quartz, generally opaque and ranging in color from white to yellow, gray, black, brown, or combinations of these. They are generally very hard and fracture conchoidally (Mason and Berry 1968:413). Chert occurs as nodules or as extensive beds in sedimentary rocks such as the Kaibab Formation, which forms the base rock of the Monument (Hartman and Wolf 1977:3).

Initially, four fairly distinct types of chert were delineated in the collection. These included a porphyritic chert, a dendritic chert, a creamy opaque chert, and other multiple colors classified simply as chert. Raw material specimens collected from gravel terraces near the Little

TABLE 7.8. Summary, Description of Raw Material Types Represented in the Wupatki Debitage.

Raw Material	Debitage Attributes				
	Number	Percent of Total	Mean Flake Weight (g)	Mean Flake Thickness (cm)	% of Flakes with Cortex
Quarzite	377	16.1	8.37	0.84	52.5
Chert	1,019	43.5	6.44	0.79	53.5
Basalt	260	11.1	7.65	0.86	28.1
Chalcedony	148	6.3	6.62	0.68	28.4
Agate	98	4.2	12.98	0.98	67.3
Jasper	19	0.8	5.16	0.76	31.7
Creamy Opaque Chert	44	1.9	7.65	0.90	68.2
Obsidian	200	8.6	2.13	0.59	69.0
Other	174	7.4	-	-	-

Colorado River indicated considerable overlap between types. Distinquishing these types was not always possible; color variations between and even within some rocks consequently made precise delineation of the rock types extremely difficult or impossible on a macroscopic basis. Therefore, in the final analysis, two types--creamy opaque chert with a waxy lustre, and chert (combining all other types)--were delineated.

Quartzite can be formed when pure quartz sandstones recrystallize under heat and pressure. It generally displays a granular texture, is very hard, and fractures conchoidally. Quartizites within the Wupatki collection range in color from red to green, black, rust, cream, and mixtures of these. Cortical surfaces on archaeological and geological specimens are predominantly of a fluvial origin.

Basalt is a black igneous rock, dense, massive, and generally fracturing conchoidally. The Wupatki collection contains vesicular basals, very fine-grained basalts occasionally containing phenocrysts, and glassy basalts, with fine-grained basalts the most common. Quaternary basalt flows erupted from volcanic cores in the area occur at several places within the Monument capping the Kaibab and Moenkopi Formations. Black Point and Woodhouse Mesa are capped with basalt flows, and both aa and pahoehoe lava fields also occur at Sunset Crater (Hartman and Wolf 1977:3-4).

Chalcedony, the generic term for cryptocrystalline quartz, is generally white grading to colorless, is somewhat translucent when held up to light, and exhibits a waxy lustre. It is generally very hard and fractures conchoidally (Mason and Berry 1968:109). It is important to note that silicified wood samples in the collection are primarily composed of chalcedony; small flakes of silicified wood are frequently difficult to dis-

tinquish from macroscopically from chalcedony.

Agate is cryptocrystalline quartz exhibiting banded colors of red, gray, black, yellow, etc. It has a waxy to dull lustre, with a tendency to be translucent and fracture conchoidally (Mason and Berry 1968:412). A few specimens of moss agate (agate containing aggregates of manganese oxides) are also included in this material type. Based on the high percentage of flakes with cortical surfaces (Table 7.8), agates appear to have been procured from local sources which were fluvially deposited.

Jasper is opaque chalcedony, generally red, yellow, or brown, the color due to colloidal particles of iron oxides (Mason and Berry 1968:413). Although distinctive, jasper occurs in only very limited quantities in the collection (Table 7.8).

Obsidian is a glassy, vitreous volcanic rock consisting primarily of aluminum and silica with a minor amount of trace elements (less than 2%). It is these trace elements that allow obsidian to be chemically "fingerprinted" through X-ray fluorescence and neutron-activation analyses, however, so it is possible to identify geologic sources with considerable precision. Several obsidian sources exist near the San Francisco Mountains and have been discussed by Jack (1971).

Obsidian comprises 8.6% of the Wupatki debitage collection. However, obsidian also has the highest frequency of cortex-covered flakes and the lowest mean flake weights and flake thicknesses. This suggests that much of the obsidian utilized in the Wupatki area consisted of small cortex-covered pebbles and some larger cortex-covered primary flakes, which were only slightly reduced prior to transport to Wupatki.

Other material types included in the collection account for 7.4% of the debitage (Table 7.8). They include rhyolite, sedimentary sandstones and siltstones, conglomerates, dolomite(?), and metamorphosed sandstones containing bands/inclusions of precipitated chert/quartz.

Artifacts

The analyzed artifact assemblage consists of projectile points, knives, drills, gravers, bifaces, unifaces, cores, and large amounts of lithic debitage.

Projectile Points

A total of 163 projectile points in a wide variety of styles were identified. Distal and medial portions of many others are undoubtedly included in the collection; however, due to their lack of hafting elements and their morphological and technological similarities with knives, drills, and other bifacial artifacts, they have been classified as bifaces and are discussed in the following section.

Projectile points were classified according to morphological characteristics, which have presumed functional significance as well. Attributes such as basal width, stem/neck width, and positioning and size of the notch opening were considered to be highly important. Size-related attributes (length, width, thickness, weight) were also considered to be significant. Detailed attribute measurements are provided in Table 7.9.

Ten major projectile point types were discerned within the projectile point collection. In addition, anywhere from two to several subtypes of these point types were delineated.

Type 1, Triangular Unnotched Projectile Points. This constitutes the largest

KEY TO TABLE 7.9.

A. Cultural Affiliation. This refers to cultural affiliation as provided in Anderson (1982; 1983; 1984; 1985; 1986; 1987).

B. General Morphology. This refers to gross morphology of projectile points and alleviates the use of specific type names.

C. Material Type
1. Quartzite
2. Chart
3. Basalt
4. Porphyritic chert
5. Chalcedony
6. Agate
7. Jasper
8. Silicified wood
9. Opalized chert
10. Dendritic chert
11. Obsidian
12. Rhyolite

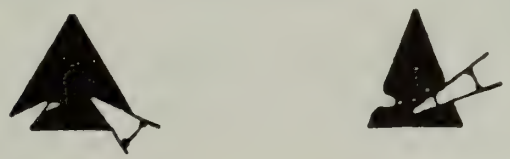
D. Cortex Type
0. Cortex not present
1. Rounded, smooth, polished
2. Rounded, rough, pitted

E. Original object
0. Indeterminate
1. Flake
2. Cobble/pebble

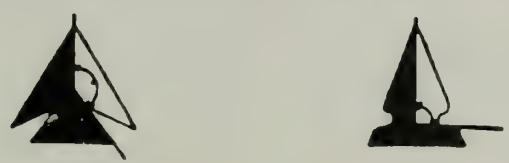
F. Condition
I. Incomplete
C. Complete

G. Flaking
0. Indeterminate
1. Random pressure flaking
2. Collateral
3. Diagonal parallel
4. Parallel
5. Percussion flaked with limited pressure retouch along margins
6. Percussion flaked

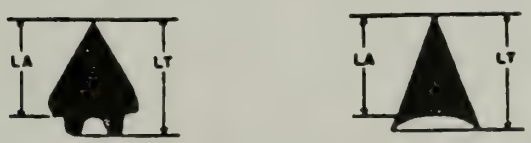
H. NO - Notch Opening. The notch opening, measured in degrees, is based on measurement techniques provided in Thomas (1981). Measurement of this variable is illustrated below.



I. PSA - Proximal Shoulder Angle. The proximal shoulder angle is measured according to the Illustration shown below.



J. BIR - Basal Indentation Ratio. The basal indention ratio follows measurement techniques provided in Thomas (1981) and is defined as the ratio of the length of the longitudinal axis (LA) to the total length of the artifact (LT) along parallel lines. Bir = La/LT.



K. Type. - Type follows the discussion of projectile point types described in the text.

TABLE 7.9. Description and Attributes of Projectile Points.

Site Number	Artifact Number	Cultural Affiliation	General Morphology	Material[c]	Cortex[d]	Orig. Object[e]	Condition[f]	Flaking[g]	Length (cm)	Width (cm)	Thickness (cm)	Neck Width (cm)	NO (°)[h]	PSA (°)[i]	BIR[j]	Weight (grams)	Type[k]
WS 103	1	Modern/PII	Small triangular unnotched, straight base	2	0	0	I	4	-	1.4	0.3	-	-	-	-	0.9	1a
WS 171	1	PII-PIII	"	5	0	1	C	5	2.7	1.3	0.3	-	-	-	-	0.7	1a
WS 182	17	PII-PIII	"	5	0	0	I	1	-	1.5	0.3	-	-	-	-	0.6	1a
WS 236	2	PII-PIII	"	2	0	0	I	5	-	1.3	0.3	-	-	-	-	0.6	1a
WS 426	-	PII-PIII	"	11	0	0	C	1	2.2	1.3	0.3	-	-	-	-	0.7	1a
WS 615	-	PII-PIII	"	11	0	0	C	2	2.7	1.2	0.3	-	-	-	-	0.8	1a
WS 1109	-	PII-PIII	"	5	0	1	C	5	2.2	1.4	0.3	-	-	-	-	1.1	1a
WS 1111	1	PIII	"	5	0	0	I	1	-	1.2	0.3	-	-	-	-	0.4	1a
WS 1132	A-1	PII-PIII	"	7	0	0	C	5	2.4	1.5	0.4	-	-	-	-	1.0	1a
WS 1326	-	PIII	"	5	0	1	I	5	-	1.1	0.3	-	-	-	-	0.6	1a
WS 1414	-	PIII	"	2	0	0	C	1	2.6	1.6	0.3	-	-	-	-	1.0	1a
WS 1434	-	PIII	"	5	0	0	C	4	3.7	1.5	0.3	-	-	-	0.97	1.5	1a
WS 1807	-	PIII	"	11	0	1	C	5	1.8	1.4	0.2	-	-	-	-	0.5	1a
WS 2086	-	PII-PIII	"	11	0	0	I	1	2.3	1.4	0.3	-	-	-	-	1.2	1a
WS 92	3	PII-PIII	Small, triangular, unnotched, concave base	2	0	0	C	I	2.1	1.5	0.4	-	-	-	0.95	0.9	1b
WS 148	1	PII-PIII	"	11	0	0	C	1	2.0	1.4	0.4	-	-	-	0.95	1.0	1b
WS 157	7	PII-PIII	"	11	0	0	I	I	-	1.1	0.3	-	-	-	-	0.2	1b
WS 206	8	PII-PIII	"	11	0	0	C	1	2.0	1.3	0.3	-	-	-	0.97	0.6	1b
WS 590	-	PII-PIII	"	6	0	1	I	1/5	-	1.5	0.3	-	-	-	-	0.6	1b
WS 892	-	PII-PIII	"	3	0	0	C	I	3.0	1.2	0.4	-	-	-	-	0.97	1b
WS 977	-	PII-PIII	"	2	0	0	I	2	-	1.4	0.3	-	-	-	-	0.8	1b
WS 1003	-	PII-PIII	"	11	0	1	C	5	2.2	1.3	0.3	-	-	-	0.90	0.7	1b
WS 1112	1	PIII	"	2	0	0	I	2	-	1.5	0.3	-	-	-	-	1.1	1b
WS 1280	-	PII	"	10	0	0	I	1	-	1.8		-	-	-	-	1.1	1b
WS 1556	1	PIII	"	6	0	0	C	1	1.9	1.4	0.4	-	-	-	0.89	0.7	1b
WS 1573	-	PII-PIII	"	2	0	0	I	1	-	1.8	0.3	-	-	-	-	0.8	1b
WS 1630	-	PII-PIII	"	11	0	1	C	5	1.6	1.2	0.3	-	-	-	0.94	0.5	1b
WS 1717	-	PII-PIII	"	12	0	0	I	1	-	1.2	0.3	-	-	-	-	0.6	1b
WS 1909	-	PII-PIII	"	5	0	0	C	1	2.5	1.3	0.3	-	-	-	0.96	1.4	1b
WS 2412	-	PII-PIII	"	11	0	0	I	2	-	1.1	0.2	-	-	-	-	0.5	1b
WS 2424	-	Unknown/ Navajo Undiff.	"	11	0	1	C	5	1.9	1.5	0.4	-	-	-	0.95	0.8	1b
WS 75	12	PIII	Small triangular, expanding base	2	0	0	C	I	2.0	1.5	0.4	-	-	-	0.95	1.0	1c
WS 933	-	PII-PIII	"	11	0	0	C	1	1.5	1.4	0.4	-	-	-	0.93	0.6	1c
WS 937	-	PII-PIII	"	2	0	0	I	5	-	1.3	0.3	-	-	-	-	0.5	1c
WS 1089	3	PII	"	11	0	0	I	2	-	1.2	0.3	-	-	-	-	0.5	1c
WS 1133	1	PII-PIII	Triangular, unnotched, concave base	3	I	0	C	I	2.3	1.3	0.4	-	-	-	0.96	1.0	1c

TABLE 7.9. (continued).

Site Number	Artifact Number	Cultural Affiliation	General Morphology	Material[c]	Cortex[d]	Orig. Object[e]	Condition[f]	Flaking[g]	Length (cm)	Width (cm)	Thickness (cm)	Neck Width (cm)	NO (°)[h]	PSA (°)[i]	BIR[j]	Weight (grams)	Type[k]
WS 1664	-	PII-PIII	Small triangular, expanding base	5	0	0	C	1	2.5	1.5	0.3	-	-	-	0.92	1.0	1c
WS 1717	-	PII-PIII	"	2	0	0	I	1	-	-	0.3	-	-	-	-	0.6	1c
WS 2001	-	A.D. 1100-1150	"	11	0	0	I	2	-	-	0.3	-	-	-	-	0.6	1c
WS 2495	-	PII-PIII	"	11	0	0	C	1	2.0	1.2	0.3	-	-	-	-	0.4	1c
WS 2620	-	PII	"	11	0	1	C	5	2.1	1.4	0.2	-	-	-	-	0.7	1c
WS 917	-	PII-PIII	Small triangular, serrated margins	11	0	0	C	2	2.6	0.9	0.3	-	-	-	-	0.9	1d
WS 2468	-	PII	"	11	0	0	C	1	2.1	0.9	0.3	-	-	-	-	0.4	1d
WS 2000	-	PII-PIII	Small triangular, deeply notched base	5	0	1	C	5	2.6	1.4	0.3	-	-	-	0.88	1.2	1e
WS 346	C	PII-PIII	Broad triangular notched base	11	0	0	C	1	2.3	2.0	0.7	-	-	-	-	2.9	1f
WS 905	-	PII-PIII	"	11	2	0	C	5	2.6	1.8	0.6	-	-	-	-	3.5	1f
WS 2298	-	Unknown	"	2	1	0	C	5	2.9	1.6	0.5	-	-	-	-	2.7	1f
WS 2374	-	PII	"	8	0	0	C	6	2.7	2.2	0.5	-	-	-	-	2.6	1f
WS 2652	-	PII-PIII	"	11	0	0	I	5	-	1.8	0.8	-	-	-	-	2.8	1f
WS 42	1	Unknown	Broad triangular, straight base	1	0	0	C	5	2.5	2.0	0.3	-	-	-	-	1.6	1g
WS 1786	-	PII-PIII	"	5	0	0	C	5	3.2	2.4	0.3	-	-	-	-	3.3	1g
WS 1145	-	PIII	Triangular, indeterminate base	11	0	0	I	2	-	-	0.3	-	-	-	-	0.7	1h
WS 1990	-	PII-PIII	"	2	0	0	I	1	-	-	0.3	-	-	-	-	0.6	1h
WS 2424	-	Unknown/ Navajo Undiff.	"	11	0	0	I	2	-	1.4	0.3	-	-	-	-	0.6	1h
WS 1108	-	PIII	Small side-notched	2	0	0	C	2	2.2	1.1	0.2	0.6	39°	109°	-	0.4	2a
WS 2621	-	PII-PIII	"	5	0	0	I	3	-	1.2	0.2	0.8	32°	94°	-	0.6	2a
WS 1107	-	PII-PIII	"	2	0	0	I	1	-	-	0.3	0.6	56°	116°	-	0.9	2b
WS 435	-	PII-PIII	"	2	0	0	I	1	2.8	-	0.3	0.9	73°	107°	-	1.7	2c
WS 2020	-	A.D. 1050-1150	"	5	0	0	C	2	3.6	1.3	0.2	1.0	90°	134°	-	1.1	2d
WS 69	2	PII-PIII	"	11	0	0	I	1	-	1.3	0.4	0.9	88°	111°	-	1.1	2e
WS 2137	-	Unknown	"	2	0	0	C	1	2.8	1.5	0.4	1.3	71°	151°	-	1.8	2f
WS 273	-	PII-PIII	Small, basal-notched	2	0	0	I	1	-	1.3	0.3	0.5	98°	-	-	0.8	3a
WS 1097	1	PII-PIII	"	11	0	0	I	2	-	1.5	0.3	-	-	-	-	1.1	3a
WS 1935	-	PII-PIII	"	2	0	0	I	2	-	1.4	0.3	0.4	50°	-	-	1.1	3a
WS 2378	-	PII-PIII	Large, basal-notched	11	0	0	I	1	-	-	0.4	-	-	-	-	2.4	3b
I04	-	Unknown	"	11	0	0	C	1	3.1	2.8	0.4	0.8	34°	162°	-	2.8	3b

TABLE 7.9. (continued).

Site Number	Artifact Number	Cultural Affiliation	General Morphology	Material[c]	Cortex[d]	Orig. Object[e]	Condition[f]	Flaking[g]	Length (cm)	Width (cm)	Thickness (cm)	Neck Width (cm)	NO (°)[h]	PSA (°)[i]	RIR[j]	Weight (grams)	Type[k]
WS 58	1	PII	Small, stemed	2	0	0	C	1	3.6	1.4	0.6	0.9	-	-	-	2.9	4
WS 878	-	PII-PIII	"	11	0	0	I	1/5	1.3	0.7	0.9	-	-	-	-	2.4	4
WS 2001	-	A.D. 1100-1150	"	11	0	0	C	1/5	2.7	1.3	0.5	0.8	-	-	-	2.2	4
WS 2424	-	Unknown/ Navajo Undiff.	"	6	0	0	C	2	3.7	1.6	0.5	0.9	-	-	-	2.5	4
I07-1	-	Unknown	Contracting stem	11	0	0	C	1	2.5	1.9	0.4	0.8	-	-	-	1.6	5
WS 1237	-	PII-PIII	"	2	0	1	C	5	4.2	2.8	0.4	1.0	-	-	-	4.3	5
WS 1611	-	PIII	"	2	0	0	I	6	-	1.9	0.5	1.0	-	-	-	2.9	5
WS 1723	-	PII-PIII	"	6	0	0	C	5	3.8	1.9	0.5	1.1	-	-	-	3.9	5
WS 2599	-	PII	"	5	0	0	I	1	-	1.5	0.5	1.0	-	-	-	2.1	5
WS 1998	-	PII-PIII	"	7	0	0	I	1	-	2.2	0.6	1.0	-	-	-	6.0	5
WS 2540	-	PII?	"	10	0	0	C	2	4.7	2.0	0.5	1.0	-	-	-	4.0	5
WS 89	1	PII-PIII	Corner-notched with narrow stem	11	0	0	I	5	-	1.9	0.6	0.9	57°	125°	-	2.9	6a
WS 199	1	PII; PIII?	"	11	0	0	C	5	3.3	1.9	0.5	1.0	91°	150°	-	2.7	6a
WS 242	-	PII	"	5	0	0	I	1	-	2.3	0.5	1.2	67°	144°	-	4.2	6a
WS 808	-	Unknown	"	6	0	0	I	1/5	-	2.9	0.6	1.3	32°	152°	-	6.6	6a
WS 971	-	PII-PIII	"	12	0	0	C	5	4.3	2.3	0.5	1.0	52°	134°	-	4.5	6a
WS 1065	1	PIII	"	2	0	0	I	5	-	2.1	0.5	1.1	78°	137°	-	6.0	6a
WS 1177	1	PII-PIII	"	5	0	0	I	5	-	2.4	0.5	1.1	-	-	-	3.9	6a
WS 1977	-	PII-PIII	"	11	0	1	C	5	3.2	1.8	0.5	1.0	65°	136°	-	2.5	6a
WS 2163	-	A.D. 1070-1125	"	5	0	0	I	5	-	1.9	0.4	1.1	52°	158°	-	2.4	6a
WS 2199	-	PII-PIII	"	2	0	0	I	2	-	2.0	0.4	1.0	62°	154°	-	4.4	6a
WS 2602	-	Unknown	"	2	0	0	I	1	-	2.4	0.5	1.0	41°	150°	-	4.3	6a
WS 540	-	PII-PIII	Corner-notched with broad stem/base	11	0	0	C	1	3.0	2.0	0.4	1.3	75°	137°	-	2.2	6b
WS 792	-	Unknown	"	5	0	0	I	5	-	2.4	0.4	1.4	-	-	-	3.4	6b
WS 1067	-	PIII	"	6	0	0	I	1	-	2.3	0.4	1.5	-	-	-	2.2	6b
WS 2285	-	PII-PIII	Corner-notched with broad stem	11	0	0	I	1	-	2.5	0.4	1.5	29°	144°	-	3.3	6b
WS 1849	-	A.D. 1 (?)	"	3	0	0	I	1	-	2.9	0.6	1.6	-	145°	0	6.0	6b
WS 1817	-	Unknown	Long, eared point	12	0	0	I	5	7.3	2.1	0.5	1.0	-	-	-	7.9	6c
WS 1136	1	PII	Large, corner-notched point/knife	3	0	0	I	5	-	2.5	0.6	1.6	76°	149°	-	6.8	6d
WS 1817	-	Unknown	"	2	0	0	C	5	4.8	2.2	0.4	1.5	116°	156°	-	5.5	6d
WS 2620	-	PII	"	2	0	0	C	1	5.9	2.5	0.4	1.2	38°	154°	-	7.1	6d
WS 381	-	PI?	Corner-notched point fragment	11	0	0	0	5	-	2.1	0.6	-	-	-	-	3.5	6e
WS 2041	-	PII	"	9	0	1	I	5	-	2.3	0.4	-	-	-	-	4.0	6e
WS 162	1	PII-PIII	Large, side-notched with concave base	6	0	0	I	1	-	1.9	0.5	1.3	54°	105°	-	3.6	7a
WS 1089	1	PII-PIII	"	6	0	0	C	1	3.4	1.8	0.6	1.5	80°	133°	-	4.0	7a

TABLE 7.9. (continued).

Site Number	Artifact Number	Cultural Affiliation	General Morphology	Material[c]	Cortex[d]	Orig. Objects[e]	Condition[f]	Flaking[g]	Length (cm)	Width (cm)	Thickness (cm)	Neck Width (cm)	ND (°)[h]	PSA (°)[i]	BIRJ	Weight (grams)	Type[k]
WS 729	-	Unknown	Large, side-notched with notched base	6	0	0	I	2	-	1.8	0.4	-	63°	128°	-	4.0	7b
WS 1082	-	PII-PIII	"	9	0	0	I	2	-	2.0	0.4	-	49°	125°	-	3.7	7b
WS 1356	-	PIII	Large, side-notched with square base	2	0	0	I	2	-	2.3	0.4	1.5	-	95°	-	7.4	7c
I02	-	Unknown	Large, side-notched with straight or slightly convex base	3	0	0	I	5	-	2.1	0.5	1.4	-	121°	-	4.8	7d
WS 118	1	PII-PIII	"	9	0	0	I	5	-	1.8	0.5	1.1	93°	133°	-	2.8	7d
WS 402	-	Unknown	"	2	0	0	I	5	-	2.2	0.6	1.5	128°	125°	-	6.3	7d
WS 765	-	Unknown	"	6	0	0	I	1	-	1.8	0.6	1.2	109°	139°	-	4.0	7d
WS 938	-	PII-PIII	"	11	0	0	C	1	3.0	1.7	0.5	1.3	88°	145°	-	3.1	7d
WS 1912	-	Unknown	"	1	0	0	I	5	-	2.2	0.5	1.7	67°	126°	-	4.2	7d
WS 2266	-	A.D. 700-	"	4	0	0	I	1	-	2.0	0.5	1.5	93°	142°	-	4.1	7d
WS 2346	-	PII-PIII	"	5	0	0	I	1	-	2.1	0.4	1.5	64°	118°	-	3.2	7d
WS 1583	-	PII	Large, side-notched, straight/slightly concave base	7	0	0	I	1	-	1.7	0.5	1.0	54°	114°	-	3.5	7e
WS 935	-	PIII	"	10	0	0	C	5	3.0	1.8	0.3	1.5	84°	137°	-	2.6	7e
WS 1291	-	PIII	Large, side-notched, straight, squarish base	7	0	0	I	2	2.9	1.6	0.5	1.4	-	82°	-	2.7	7f
WS 1089	-	PII-PIII	"	5	0	0	I	1	-	-	0.5	1.1	-	123°	-	4.6	7f
WS 1827	-	Unknown	"	2	0	0	C	5	4.7	2.3	0.3	1.3	-	110°	-	4.8	7f
WS 366	-	PII-PIII	Large, side-notched, low notches, square base	2	0	0	I	1	-	1.9	0.6	1.2	111°	129°	-	5.3	7g
WS 2606	-	PII-PIII	"	11	0	0	C	1	3.7	2.1	0.5	1.2	-	111°	-	4.4	7g
WS 797	-	Unknown	Indeterminate, large, side-notched point fragment	10	0	0	I	5	-	1.8	0.4	-	-	-	-	2.6	7h
WS 821	-	Unknown	"	2	0	1	I	2	-	1.9	0.5	1.3	-	-	-	4.5	7h
WS 2044	-	PIII	"	2	0	0	I	5	-	-	0.5	-	-	-	-	3.6	7h
WS 1583	-	PII	"	11	0	0	I	5	-	2.0	0.3	-	-	-	-	1.7	7h
WS 2266	-	A.D. 700-1050/A.D. 1150-1250	Medium, broad-stemmed	5	0	0	C	1	3.3	2.0	0.6	1.5	-	-	-	3.5	8a
WS 1132	I	PII-PIII	"	11	0	0	C	1	3.0	2.0	0.7	1.5	-	-	-	3.6	8a
WS 2097	-	PII-PIII	Medium, narrow-stemmed	5	0	0	I	3	-	1.4	0.5	1.0	-	-	-	3.0	8b
I01	-	Unknown	Medium, bifurcated stem	8	0	1	C	1/5	3.1	1.5	0.5	1.4	-	-	0.93	2.9	8c
WS 799	-	Unknown	"	11	0	0	C	5	2.7	1.7	0.7	1.6	-	-	0.93	3.6	8c
WS 893	-	PII-PIII	"	11	0	0	I	1	-	1.8	0.8	1.2	-	-	-	4.6	8c
WS 903	-	PII-PIII	"	11	0	0	I	5	-	1.7	0.7	1.4	-	-	-	3.0	8c
WS 933	-	PII-PIII	"	3	0	0	C	5	3.1	1.8	0.6	1.4	-	-	0.94	3.4	8c

TABLE 7.9. (concluded).

Site Number	Artifact Number	Cultural Affiliation	General Morphology	Material[c]	Cortex[d]	Orig. Object[e]	Condition[f]	Flaking[g]	Length (cm)	Width (cm)	Thickness (cm)	Neck Width (cm)	NO (°)[h]	PSA (°)[i]	BIR[j]	Weight (grams)	Type[k]
WS 1086	1	PIII	Medium, bifurcated stem	11	0	0	I	1	-	1.8	0.6	1.5	-	-	-	2.9	8c
WS 1644	-	PII-PIII	"	11	0	0	C	1	2.9	1.5	0.7	1.3	-	-	0.93	3.2	8c
WS 2575	-	PIII	"	11	[illegible]	0	I	1	-	1.5	0.5	1.3	-	-	-	2.2	8c
WS 2660	-	PII	"	11	0	0	I	1/5	-	1.8	0.6	1.5	-	-	-	2.5	8c
I032	-	Unknown	"	12	0	0	I	5	-	1.9	0.6	-	-	-	-	4.5	8c
WS 70	1	PII-PIII	"	10	0	0	I	1	-	2.2	0.7	1.3	-	-	-	4.4	8c
WS 166	1	PIII	"	5	0	0	I	1	-	2.1	0.7	1.7	-	-	-	6.2	8c
WS 330	-	Historic Navajo	"	5	0	0	I	1	-	2.0	0.5	1.4	-	-	-	3.7	8c
WS 792	-	Unknown	"	5	0	0	I	1	-	1.8	0.5	1.1	-	-	-	2.7	8c
WS 795	-	PII-PIII	"	10	0	0	I	1	-	-	0.6	1.7	-	-	-	3.5	8c
WS 876	-	PII	"	5	0	0	I	5	-	2.1	0.7	1.5	-	-	-	6.2	8c
WS 1474	-	PII-PIII	"	7	0	0	I	5	-	1.7	0.5	1.4	-	-	-	2.0	8c
WS 2597	-	PII-PIII	"	5	[illegible]	0	C	1	3.9	2.1	0.7	1.7	-	-	0.90	5.8	8c
WS 2602	-	Unknown	"	6	0	0	I	1	-	1.9	0.5	1.4	-	-	-	4.2	8c
WS 1357	-	PIII	Medium, single-shouldered, stemmed	11	0	0	I	5	-	1.7	0.8	1.4	-	-	-	4.5	8d
WS 87	1	PII-PIII/ Navajo	Medium, stemmed indeterminate base	11	0	0	I	1/5	-	1.8	0.7	1.0	-	-	-	6.2	8e
WS 1571	-	PII-PIII	"	6	0	0	I	3	-	1.6	0.5	1.2	-	-	-	2.5	8e
WS 1051	1	Unknown	Large, long-stemmed point	2	0	0	I	1	-	2.3	0.8	1.5	-	-	-	7.0	9a
WS 2313	-	A.D. 1100-	Large, short-stemmed point	11	0	0	I	5	-	2.5	0.4	1.5	-	-	-	2.8	9b
I04	-	Unknown	Large, broad-stemmed point	10	0	0	C	2	6.7	3.1	0.8	1.9	-	-	-	17.0	9c
WS 1340	-	Paleo-Indian	Broad, fluted lanceolate point (Clovis)	2	0	0	C	2	5.5	2.7	0.9	-	-	-	0.93	13.1	10a
WS 313	-	Historic Navajo	Long, slender lenticular point	5	0	0	I	5	5.8	2.4	0.7	-	-	-	-	10.5	10b
WS 425	-	Unknown	"	6	0	0	I	5	6.0	-	0.5	-	-	-	-	7.1	10b
WS 1833	-	Unknown	"	6	0	0	C	1/5	6.0	2.2	0.6	-	-	-	-	9.4	10b
WS 55	1	PII-PIII	Small lanceolate point	11	0	0	I	1	-	1.5	0.4	-	-	-	-	2.2	10c
WS 233	1	PII-PIII	Leaf-shaped, lanceolate point	2	0	0	C	2	4.8	1.9	0.5	-	-	-	-	4.6	10c
WS 2634	-	PII-PIII	Concave base, lanceolate point	11	0	0	I	1	-	1.9	0.7	-	-	-	-	3.0	10d
WS 114	1	PII-PIII	Concave base, point fragment (indeterminate)	11	0	0	I	0	-	1.6	0.5	-	-	-	-	1.7	
WS 848	-	Unknown	"	5	[illegible]	0	I	1	-	1.7	0.5	-	-	-	-	1.1	
WS 905	-	PII-PIII	"	11	1	2	I	0	-	1.5	0.5	-	-	-	-	1.7	
WS 1071	1	PIII	Notched point fragment (indeterminate)	6	0	0	I	2	-	1.6	0.4	1.1	-	-	-	2.2	
WS 1097	2	PII-PIII	"	8	0	0	I	2	-	1.8	0.4	1.0	-	-	-	2.8	

group of artifacts within the Wupatki projectile-point sample (N = 53). Based on overall size and basal attribute differences, seven subtypes have been discerned. Admittedly, many of these differences are subtle; the recovery of additional specimens from well-dated contexts in the Wupatki area may indicate that some of these subtypes should be merged.

Type 1a consists of small, triangular, unnotched points with straight bases (Fig. 7.41) (N = 14). Most were apparently manufactured from small flakes. Type 1a points are less than 2.8 cm in length and weigh less than 1.8 g. Type 1b points (N = 17) are similar to Type 1a points but have slightly concave bases (Fig. 7.41). These points are also small (length less than 3.0 cm; width less than 1.9 cm; weight less that 1.2 g) and have a basal indention ratio (Table 7.9) ranging from 0.89 to 0.97. Type 1c consists of 10 triangular, unnotched points with expanding bases (Fig. 7.41). These points are highly similar in overall size and morphology to Type 1a and Type 1b points except that the lateral margins of Type 1c points slightly expand near their bases, whereas Type 1a and Type 1b point maintain relatively straight lateral margins for their entire length.

Type 1d consists of two small, triangular, unnotched points with serrated margins. These points resemble isosceles triangles, with the length of the lateral margins slightly greater than two times the width of their base (Fig. 7.41). Their narrow tips also suggest possible use in piercing or perforating. Type 1e is composed of a single small, triangular, basally-notched point (Fig. 7.41).

Type 1f and Type 1g points differ from Types 1a-1e in being significantly larger. Type 1f are broad, triangular points with notched bases (N = 5), wider (1.8 cm to 2.0 cm) and thicker (0.5 cm to 0.8 cm) than the types listed above, and possibly manufactured from thick flakes (Fig. 7.41). Type 1g consists of a single broad, triangular point with a straight base. This specimen (Fig. 1s), which exhibits large expanding flake scars over both faces and limited pressure flaking along its margins, may be a preform for one of the other Type 1 points listed above. Type 1h consists of three triangular point fragments. While the overall triangular form of these points is discernible, basal fracture prohibits classification into one of the types above.

Nearly 95% of all Type 1 points were recovered from sites believed to date to the Pueblo II-Pueblo III periods. McGregor (1941: Fig. 64) illustrates Type 1a, 1b and 1c points recovered during excavations of Winona and Ridge Ruin. These were assigned to temporal components dating from approximately A.D. 1070 to A.D. 1150, an age range consistent with their occurrence at sites in the Wupatki area. Some of the Type 1b specimens are similar to Bull Creek points. Bull Creek points have been recovered at Kayenta Anasazi sites dated A.D 950 and A.D. 1250 (Holmer 1980:107-108).

Type 2, Small Side-Notched Projectile Points. This class of artifacts consists of seven morphologically diverse specimens,which have been further divided into six subtypes.

Type 2a consists of two small, side-notched points with high side notches and concave bases. The diminutive side notches are placed relatively high (0.7 cm to 0.8 cm from the base) on the lateral margins (Fig. 7.42). These points resemble Type 1b triangular points and may in fact be modified Type 1b points. Type 2b is represented by a single small, side-notched point with high side notches, a straight base, and parallel blade margins. Side notches are placed 0.9

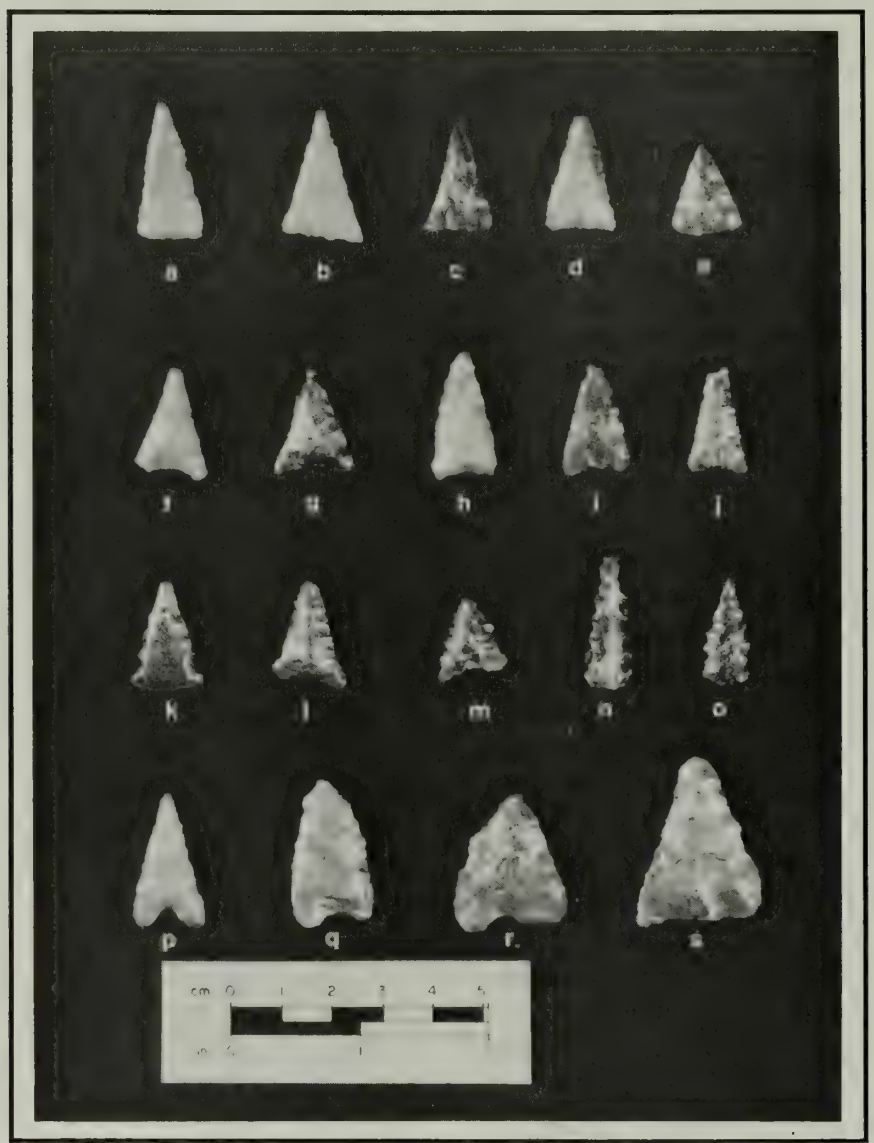


FIGURE 7.41. Type 1 projectile points. a-e, Type 1a: a, WS-171.1; b,WS1414; c, WS-426; d, WA-1807; e, WS-92.3. f-j, type 1b:f, WS-92.3; g, WS-148.1; h, WS-1909; i, WS-1003; j,WS-2412. k-m, Type 1c: k, WS-2620; 1, WS 75.12; m,WS-933. n-o, Type 1d: n, WS-917; o, WS-2468. p, Type 1e:p, WS-2000. q-r, Type 1f: q, WS-2298; r, WS-2374. s,Type 1g: s, WS-1786.

cm from the base, which is roughly square and expanding (Fig. 7.42).

Type 2c is a small, side-notched point with low (0.5 cm from the base) side notches and a large straight base. This specimen also has slightly convex blade margins. Type 2d is a small,side-notched point with low side notches and a small straight base. It is triangular, with shallow side notches placed 0.4 cm from the bases (Fig. 7.42). Type 2e is a small side-notched point, notched low (0.3 cm from the base), with straight, parallel blade margins and a small but expanding base (Fig. 7.42). Type 2f consists of a single small, side-notched point with low broad side notches and a concave base. This specimen also has triangular, slightly expanding blade margins (Fig. 7.42).

All Type 2 points with the exception of the single Type 2f point were recovered from sites attributed to the Pueblo II-Pueblo III occupation periods. Type 2a appears highly similar to points assigned to the Elden Focus (ca. A.D. 1085 to A.D. 1125) at Winona and Ridge Ruin (McGregor 1941:Fig. 64n).

Type 3, Basal-Notched Projectile Points. Two subtypes of basal-notched points were discerned in the collection--small (Type 3a) and large (Type 3b). Type 3a points are represented by three incomplete specimens that are triangular in form with prominent basal tangs (Fig. 7.42). Finished points probably weighed less than 1.3 g. Type 3b points, represented by one complete and one incomplete specimen, are also triangular in form but with broad artifact widths and comparatively small, narrow stems (Fig. 7.42).

With the exception of one Type 3b point, all Type 3 points were recovered from sites associated with the Pueblo II-Pueblo III periods. Two specimens similar to Type 3a points were recovered at Winona and Ridge Ruin in contexts dated between about A.D. 1075 and A.D. 1130 (McGregor 1941:Figure 64r).

Type 4, Small-Stemmed Projectile Points. This class is represented by three complete and one incomplete specimen. They are generally narrow points with parallel blade margins and short, straight to slightly expanding stems (Fig. 7.42). The weight of these specimens ranges from 2.2 to 2.9 g.

Three Type 4 points were recovered from sites dated to the Pueblo II-Pueblo III periods, while one is from a site of unknown or possibly Navajo affiliation.

Type 5, Contracting Stem Projectile Points. This class of projectile points is represented by four complete and three incomplete specimens. These points have an overall triangular blade form with straight to slightly expanding lateral margins, rounded shoulders, and a contracting stem (Fig. 7.42). While there is a considerable range of sizes (from 1.9 to over 6.0 g), the overall morphology is very similar.

Although four of the five specimens were recovered on sites dated to the Pueblo II and Pueblo III periods, the larger points in this classification are very similar to Gypsum points found in the southern portion of the Intermountain West and dated between 2500 B.C. and A.D. 500 (Holmer 1978:105). Their occurrence on Puebloan sites at Wupatki may simply reflect collection and reuse of Archaic points by Formative populations.

Type 6, Corner-Notched Projectile Points. As a group, corner-notched points exhibit considerable variablity. Based on overall size, notch placement, and basal attributes, four subtypes were defined.

Type 6a is comprised of 11 corner-notched points (3 complete specimens) with relatively narrow stems, triangular blade forms, and expanding bases. The basal width is approximately one-half or slightly

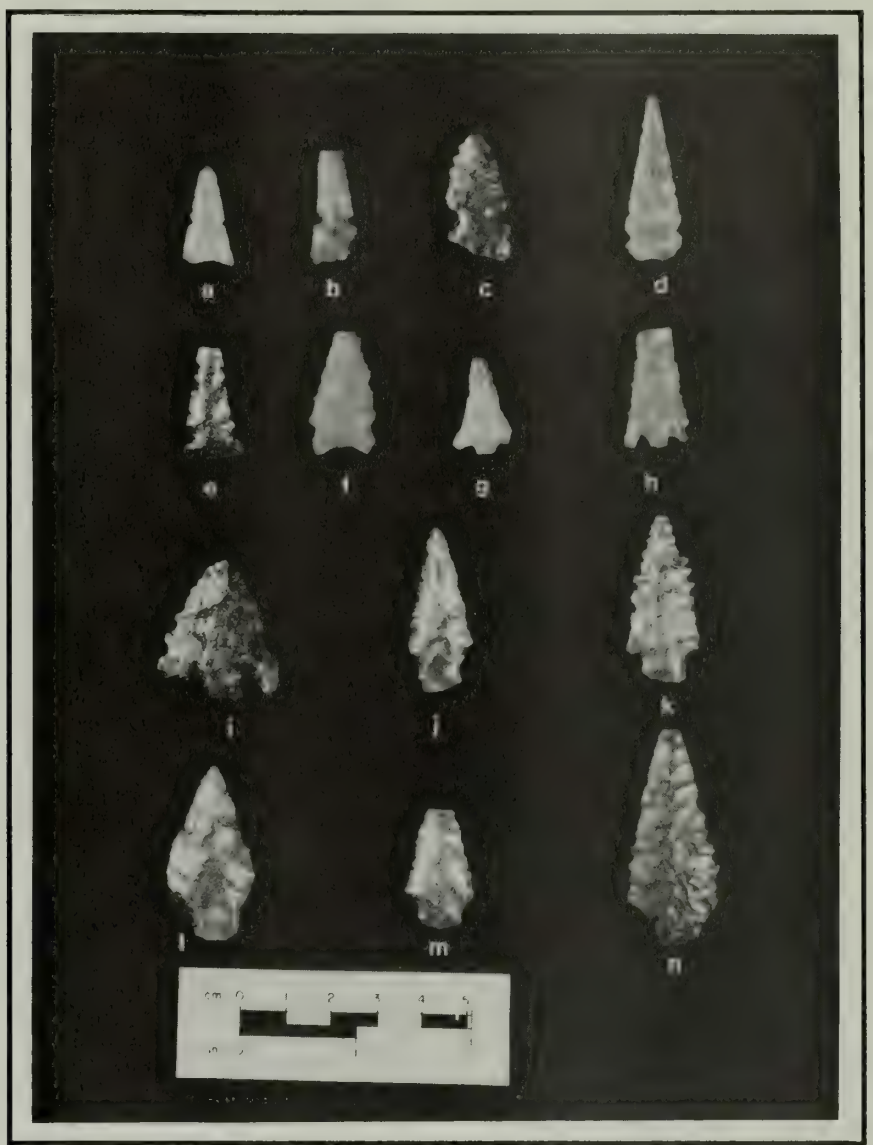


FIGURE 7.42. Types 2,3,4, and 5 projectile points. a, Type 2a: a, WS-1108. b, Type 2b: b, WS-1107. c, Type 2c: c,WS-435. d, Type 2d: d, WS-2030. e, Type 2e: e, WS-69.2.f, Type 2f: f, WS-2137. g-h, Type 3a: g, WS-273; h,WS-1935. i, Type 3b: i, 10-4. j-k, Type 4: j, WS-58.1; k, WS-2424. 1-n, Type 5: 1, WS-1723; m, WS-2599; n,WS-2540.

greater than the maximum artifact width. Bases are straight to slightly convex, and shoulders are straight to slightly overhanging (Fig. 7.43). Type 6b is represented by five specimens. The general morphology of these points is highly similar to Type 6a points except that the bases of Type 6b points are wider--generally about 3/4 as wide as the maximum artifact width (Figure 7.43). One specimen has a concave base.

Type 6c is represented by a single long corner-notched projectile point with straight, generally parallel blades, straight shoulders, and a deeply notched base (Fig. 7.43). This item may have functioned as a knife. Type 6d is comprised of three large corner-notched points/knives, which artifacts have triangular blade forms, broad corner notches, and expanding stems with convex bases (Fig. 7.43). While similar in form to Types 6a and 6b, Type 6d points are much larger than other corner-notched varieties. Type 6e consists of two indeterminate corner-notched point fragments. Although remnants of corner notches can be discerned on these specimens, the bases are so fragmentary that further classification into one of the above types was not possible.

Nearly all (12 of 14) of the Type 6a and Type 6b points were recovered from sites attributed to the Pueblo II-Pueblo III periods, while the single large Type 6c point was recovered from a site of unknown origin. Two of the three Type 6d points were recovered from sites estimated to date to the Pueblo II period. Many of the larger corner-notched points are similar to Archaic corner-notched varieties found elsewhere, and Holmer (1978) suggests that these large corner-notched points represented an effective hafting adaptation, which could have been used by later populations as knives.

Type 7, Large Side-Notched Projectile Points. This is a highly diverse group of projectile points; consequently, seven subtypes have been delineated.

The single Type 7a point is triangular in form with convex lateral margins. The blade margins continue in a smooth, gentle arc to the base, and notches are broad and placed low. The base is concave (Fig. 7.43). Type 7b points (N = 2) possess straight, parallel blade margins that continue in a straight line to the base. Side notches are small and shallow, and the base is deeply notched (Fig. 7.43). Type 7c is represented by a single large specimen that may be a knife. It has straight parallel blades, toderately deep side notches, and a square and slightly concave base (Fig. 7.43).

Type 7d consists of eight points with relatively broad notch openings placed low on the lateral margins. The bases are straight to slightly convex (Fig. 7.43). Type 7e points (N = 2) are triangular in form, with slightly convex blade margins, small shallow side notches placed low on their blades, and a straight or slightly concave base (Fig. 7.44). The three specimens comprising Type 7f are triangular points with convex blades, relatively small side notches placed low on their blades, and straight bases that are slightly wider than their blades (Fig. 7.44). Type 7g points are relatively large with triangular blade forms, straight to slightly convex lateral margins, and notches generally placed low, forming a square base (Fig. 7.44). Type 7h consists of large side-notched point fragments, which are so fragmentary that further classification is unwarranted.

Within the Wupatki region, Type 7 points have most frequently been recovered on sites attributed to the Pueblo II and Pueblo III periods; however, some exceptions should be noted. Most notable, several of the Type 7d points were recovered from sites of unknown origin, and one was recovered from a site with a hypothesized

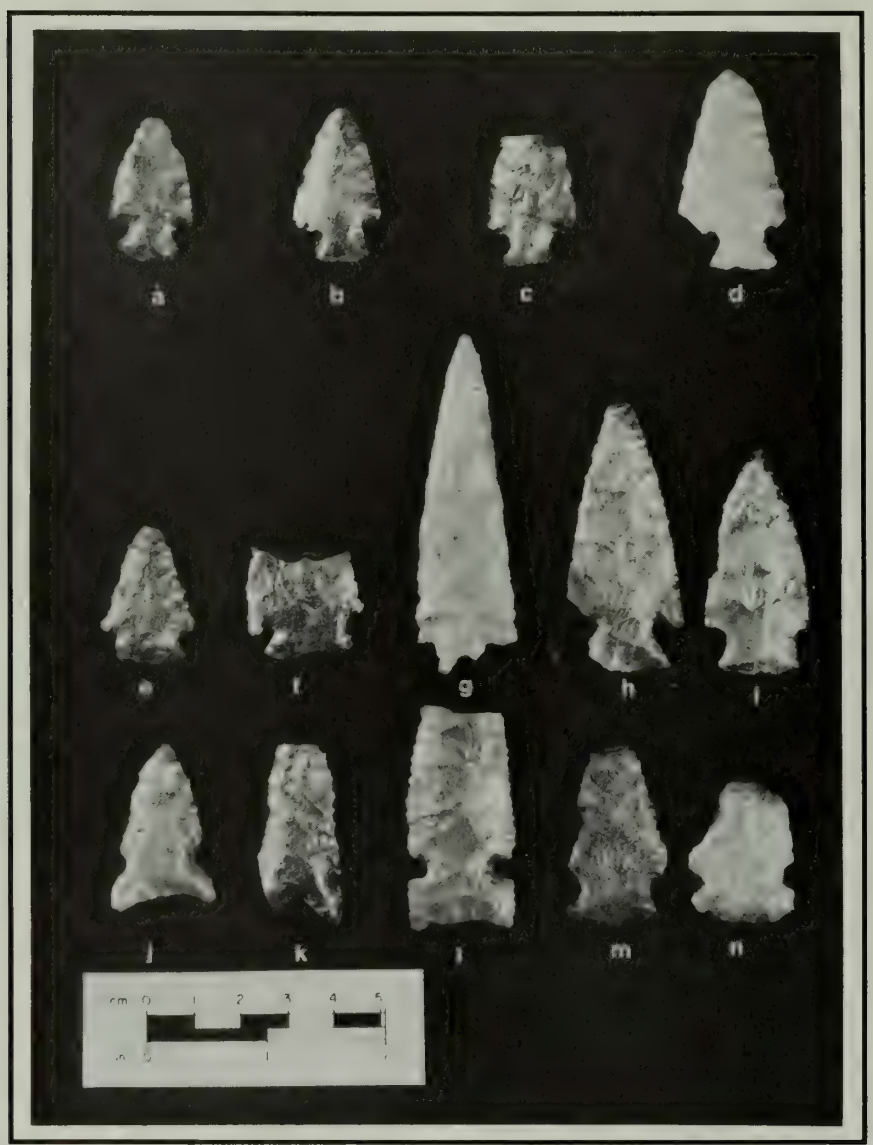


FIGURE 7.43. Type 6 and Type 7 projectile points. a-d, Type 6a: a, WS-1977; b, WS-199-1, c, WS-971. e-f, Type 6b: e,WS-540; f, WS-2285. g, Type 6c: g, WS-1817. h-i, Type 6d: h, WS-2620; i, WS-1817. j, Type 7a: j, WS-1089. k,Type 7b: k, WS-729. 1, Type 7c: 1, WS-1356. m-n, type 7d: m, 10-2; n, WS-1912.

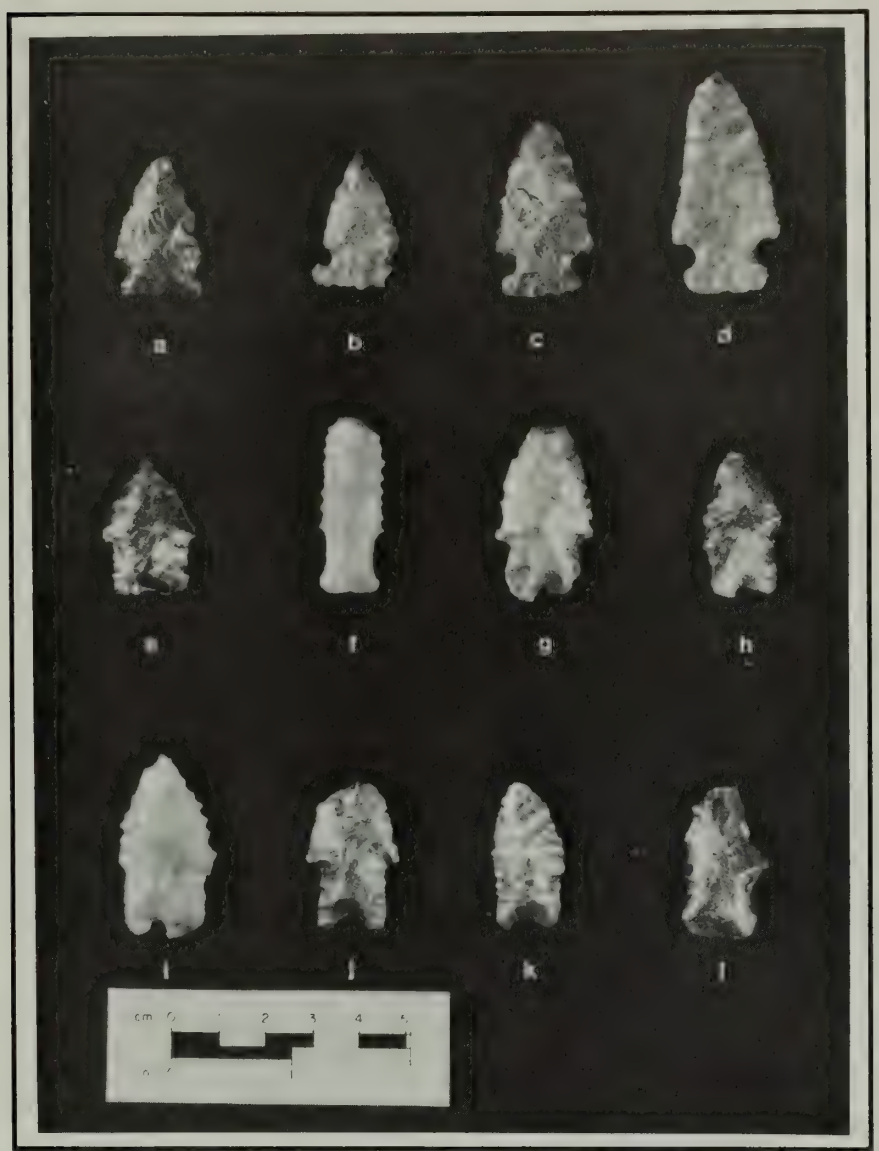


FIGURE 7.44. Type 7 and Type 8 projectile points. a, Type 7e: a,WS-935. b, Type 7f: b, WS-1291. c-d, Type 7g: c, WS-2606;d, WS-1827. e Type 8a: e, WS-1132. f, Type 8b: f,WS-2097. g-k, Type 8c: g, WS-876; h, WS-933; i, WS-2597j, WS-330; k, 10-1. 1, Type 8d: 1, WS-1357.

Pueblo I occupation. Woodbury (1954:Fig. 25u-v, Fig. 25) illustrates two points roughly similar to Type 7d points that were recovered from a Basketmaker III-early Pueblo I site. If the Type 7 points are indeed associated with the Formative Stage in the area, it appears likely that most served as hafted knives rather than as projectile points.

Type 8, Medium-Stemmed Projectile Point. This class of artifacts is made up of several subtypes of medium-sized (2.9 cm to 3.9 cm in length: 1.4 cm to 2.2 cm in width) stemmed projectile points, composed of 25 specimens.

The two specimens in Type 8a have a roughly equilateral triangular blade form, broad, square-shaped stems (Fig. 7.44), and relatively thick cross sections. In contrast, the single Type 8b point is a long, narrow point with parallel and serrated lateral margins. The stem is long and expanding (Fig. 7.44).

Type 8c, with 19 specimens, comprises the largest subtype in this class. These points have triangular blade forms with square, bifurcated stems/slightly concave bases (Fig. 7.44). Their shoulders are somewhat variable, ranging from sharp, well-defined shoulders to gently rounded ones.

Type 8d, represented by a single specimen, is quite similar to Type 8c points except that it possesses a straight, slightly expanding base and a single shoulder (Fig. 7.44). The final Type 8 point type (Type 8e) is composed of two medium-sized stemmed point fragments that could not be classified into one of the above types.

Where temporal assignments could be made, Type 8 points have been most frequently recovered on sites attributed to the Formative Stage. Type 8a and 8b points have been recovered in the Wupatki region at sites estimated to date from the Pueblo I-Pueblo III periods. While 13 of the 20 Type 8c points were collected from Puebloan sites, 1 came from a historic Navajo site and 6 from sites of unknown origin. Most important, though, are the strong similarities between Type 8c points and Pinto points. The latter have been documented at many sites throughout the Colorado Plateau and in the Mojave Desert and are accepted to date to the period just following the Paleoindian occupation of the pluvial lake shores in the Mojave Desert (Warren 1980:67). Because of their strong resemblance, it is likely that many of the Type 8c specimens are indeed Pinto points. While not exhibiting a bifurcated stem, the single type 8d point is stylistically similar to Pinto single-shouldered points believed to date to the same period (Holmer 1986:97-101).

Type 9, Large-Stemmed Projectile Points. This class consists of three specimens. The first (Type 9a) is a large, long-stemmed projectile point with a triangular blade form with convex blades (Fig. 7.45). The second item (Type 9b) consists of the basal portion of a large-stemmed point. Lateral margins appear to have been long and parallel. The stem and base are straight, while the shoulders are oriented at approximately a 90 degree angle to the longitudinal axis of the artifact (Fig. 7.45). Type 9c is also represented by a single very large-stemmed point (Figure 7.45). This point has a large triangular blade form, convex blade margins, and a large, slightly contracting stem with a convex base.

Both the Type 9a and Type 9c points were collected from sites whose age is unknown, while the Type 9b point was recovered from a site attributed to the Pueblo III period. The Type 9a and Type 9b points are similar to points placed in the Western Stemmed-Point Tradition and are thought to date to the late Paleoindian or

FIGURE 7.45. Type 9 and Type 10 projectile points. a, Type 9a: a,WS-1051. b, Type 9b: b, WS-2313. c, Type 9c: c, 10-4.d, Type 10a: d, WS-1340. e, Type 10b: e, WS-1833. f-g, Type 10c: f, WS-233.1; g, WS-55; h, WS-2634.

possibly the early Archaic period (Carlson 1983:78).

Type 10, Lanceolate Projectile Points. Type 10 is comprised of seven specimens divided into four fairly distinct subtypes. The first (Type 10a) is a broad, concave base and fluted lanceolate Clovis point (Figure 7.45). Manufactured from a green and black-banded chert, this specimen is biconvex in cross section and has relatively broad expanding pressure flake scars on its lateral margins that are truncated on both faces by flutes, which end in step/hinge fractures. The flutes extend to or just beyond the mid point of the length of the point. The lateral margins are ground from the base up to 2.0 cm. All of these features are common on Clovis points (Cordell 1984:129-131).

Type 10b consists of three long, slender, and lenticulate points (Fig. 7.45). Type 10c is represented by two leaf-shaped lanceolate points, one of which exhibits excessive heat-treatment features (Fig. 7.45). Type 10d consists of a single concave-base lanceolate point exhibiting a thick biconvex cross section and convex lateral margins (Fig. 7.45).

Clovis points (Type 10a) are firmly dated between 9500 and 9000 B.C. and are frequently associated with the remains of mammoth (Cordell 1984:131). The cultural affiliation of Type 10b points in the Wupatki region is not known. Two items are from sites of unknown origin, and one is from a historic Navajo site. Woodbury (1954:Fig. 27j) illustrates a roughly similar point from a site of unknown origin. All of the Type 10c and 10d points were recovered from sites in the Wupatki region estimated to date to the Pueblo II-Pueblo III periods.

Cultural-period associations for the sites from which the defined projectile point types were collected, based on architectural and ceramic seriation, are provided in Table 7.9. However, it should be emphasized that the analyzed projectile point assemblage is relatively small and derived from surface collections; thus, the temporal associations presented here should be considered somewhat tentative. Reuse of projectile points can greatly affect temporal interpretations and remains a important consideration in the analysis of surface-collected artifacts. While the temporal associations of some types will probably be borne out with further research, data acquired from excavated sites providing stratigraphic associations, radiocarbon dates, and other absolute dates will probably amend some of these results.

Bifaces

In addition to bifacially flaked specimens classified as projectile points, knives, drills, and gravers, 137 bifaces in a variety of styles are included in the Wupatki flaked lithic artifact collection. Like other bifacial artifacts, bifaces have flake scars essentially covering the entire surface of both their faces. However, these bifaces lack hafting elements, modified projections, or other specialized attributes, making classification into one of the above biface categories unfeasible. Undoubtedly, many of the artifacts included in this category represent indeterminate portions of projectile points, while some of the larger, more complete specimens would traditionally be referred to as knives; others are probably blanks and preforms.

Beyond compiling basic descriptive data on bifaces, data for evaluating reduction stages of bifaces were compiled. These included computation of a thickness-to-width ratio (width/thickness, rounded to the nearest whole number) and an evaluation of flake-scar patterns. Use of these two variables is derived largely from Womack's (1977) detailed technological analysis and replicative experiments at an aboriginal

quarry site characterized by extensive biface manufacture. While other factors, such as edge sinuosity and platform preparation, are important considerations in the analysis of biface reduction stages, these two are believed to be sufficiently reliable variables to provide a preliminary examination of biface reduction strategies as revealed in the Wupatki collection.

The bifaces were classified into one of four reduction stages. This implies that the Wupatki flintknappers necessarily envisioned biface reduction as proceeding in four discrete, progressive stages. Because raw material quality, size, shape, and cortex attributes conditioned reduction techniques, bifaces need not pass through each of the stages. Specifically, a flake of the appropriate size and thickness for a projectile point preform might begin at Stage II, whereas beginning a biface from a cortex-covered cobble would require more extensive reduction, in which the envisioned item could pass through all four stages before the final form, such as a projectile point, was reached. Obviously, any stage might be interrupted by breakage or a decision by the flintknapper to abort the process. Because the biface sample is relatively small, derived from a large number of archaeological sites, and represented by a wide variety of raw material types, the four-stage model is used primarily as a classification-description tool.

Stage I Bifaces. Nine Stage I bifaces, six complete and three incomplete, are represented in the collection (Figure 7.46). Stage I bifaces exhibit thick cross-sections and deep, broad, and expanding flake scars. Margins are markedly sinuous. Hinge-and-step fractures, often stacked and resulting from excessive or improperly directed force with hard percussors (e.g., hammerstones), are common on Stage I bifaces. Flake scars may exhibit pronounced force lines and radial striations. Striking platforms occasionally show evidence of repeated battering. Cortical surfaces, present on six of the nine Stage I bifaces, are of fluvial origin and indicate procurement from active river-channel deposits and/or ancient terraces. Dimensions of Stage I bifaces are presented in Table 7.10.

Stage II Bifaces. Stage II bifaces are represented by a total of 19 specimens, 8 of which are complete (Fig. 7.46). In contrast with Stage I bifaces, those in Stage II exhibit significant decreases in mean length, width, and thickness (Table 7.10). Edges, while irregular, exhibit a much straighter line than Stage I bifaces. Flake scars are irregular, but with more shallow negative bulbs of force and less pronounced force lines. Hinge-and-step fractures occur far less frequently. Six (31.5%) items retain cortex. Womack (1977) and Crabtree (1972) suggest that these characteristics may result from a shift to an antler billet. Cherts (36.8%) and obsidian (21.0%) account for the majority of Stage II bifaces.

Stage III Bifaces. Stage III bifaces are represented by a total of 44 specimens; only 11 (25%) are complete (Fig. 7.46). While there are no significanct decreases in overall length or width from Stage II to Stage III, the thickness of Stage III bifaces decreases by aproximately 30% (Table 7.10). Some appear to have been manufactured from flakes. As noted above, breakage is far more common among Stage III than it is in either Stage I or Stage II bifaces. Breakage generally occurs transversally, most commonly as end-shock and perverse fractures. Flake scars are more regular, less expanding, and more diffuse. Hinge-and-step fractures occur infrequently. Edges are only slightly sinuous.

Stage III bifaces closely approximate finished implements with the exception of final thinning, pressure retouch, and sometimes the addition of hafting elements

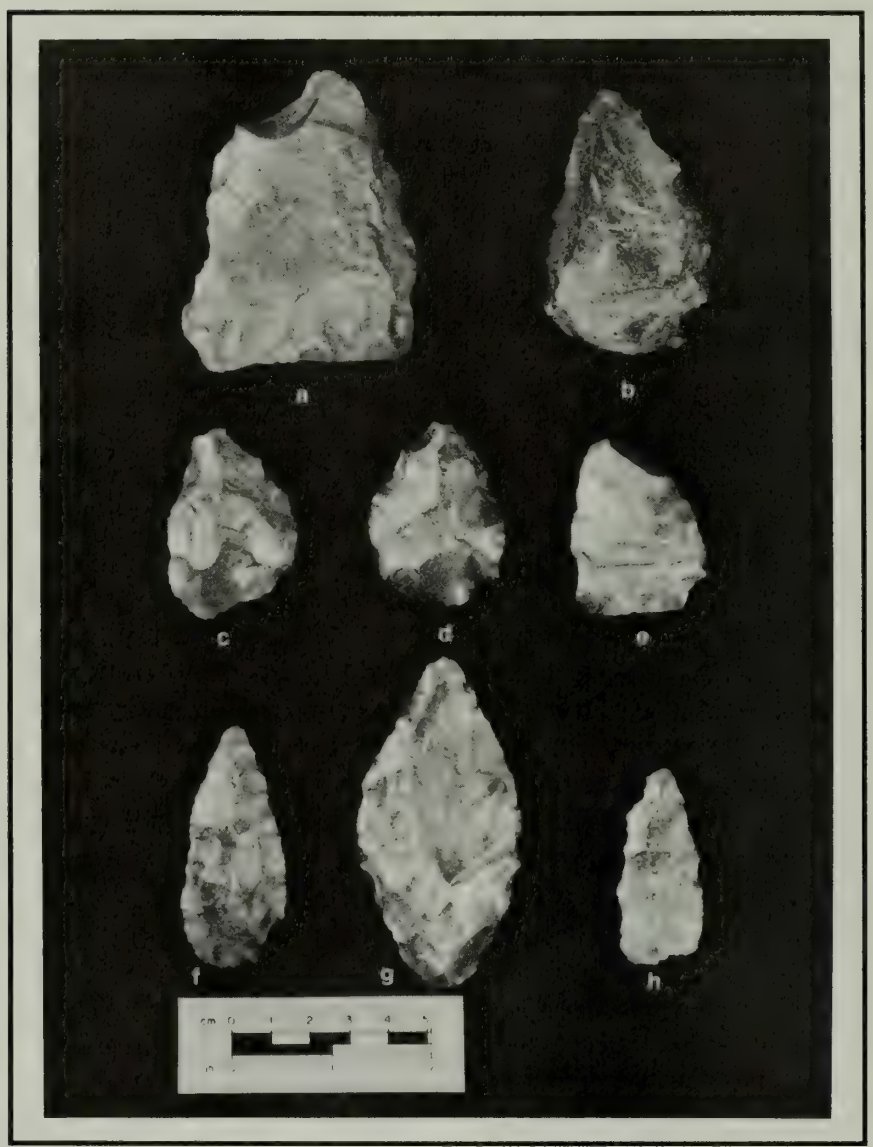


FIGURE 7.46. Stage I-III bifaces. a-b, stage I bifaces: a, WS-1635;b, WS-2344. c-e, stage II bifaces: c, WS-1071; d, WS-1589; e, WS-1668. f-h, stage III bifaces: f, 10-3; g, WS-1378.5; h, WS-2360.

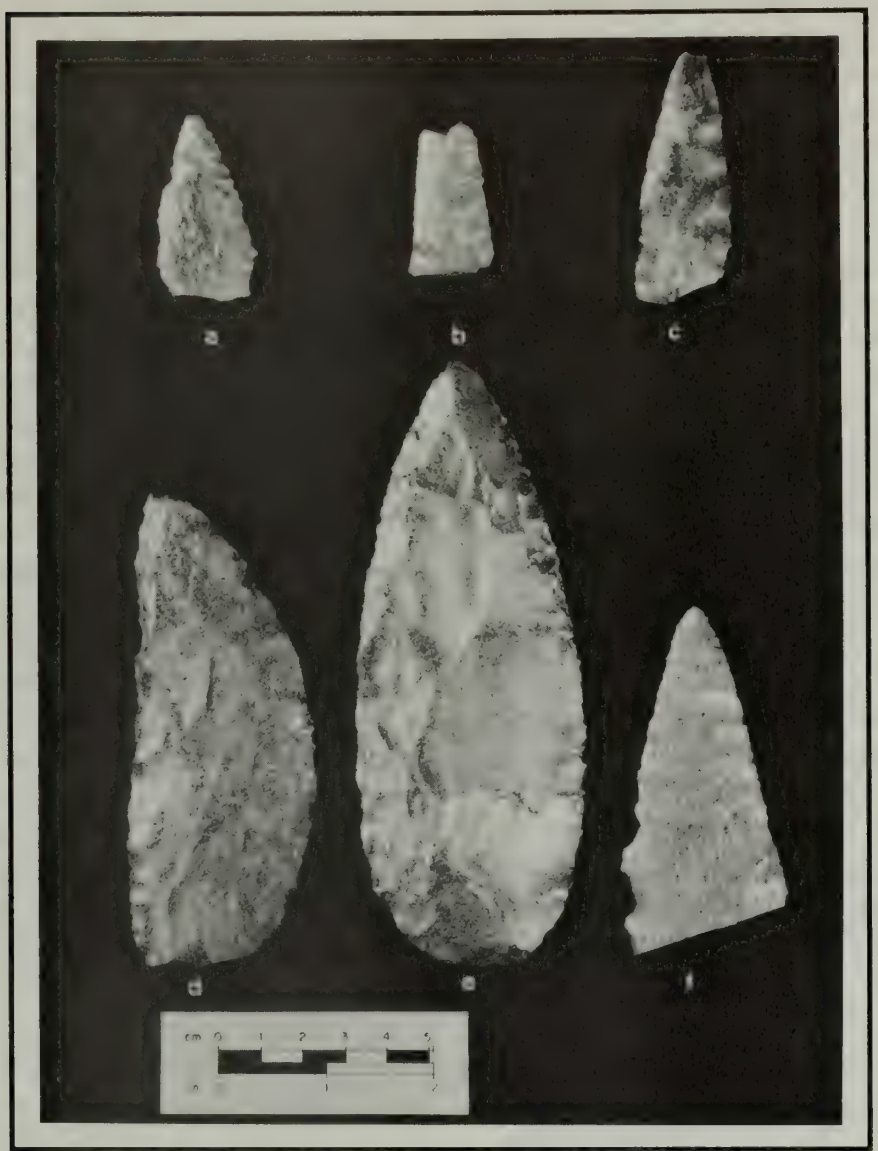


FIGURE 7.47. Stage IV bifaces. a-c, stage IV bifaces: a, WS-43; b, WS-1067; c, WS-1045. d-f, large stage IV bifaces: d, WS-1348; e, WS-2167; f, WS-1448.

(Womack 1977:48) or specialized projections for piercing/drilling. Again, cherts (34.1%) and obsidian (31.8%) are the most frequent raw materials used in Stage III bifaces, followed by chalcedony (6.8%) and agate (6.8%).

Stage IV Bifaces. A total of 57 Stage IV bifaces were identified in the collection (Fig. 7.47), of which only two (3.5%) are complete. Stage IV bifaces exhibit regular plan outlines, straight edges, and regular flake scars with diffuse negative bulbs of force. At this stage, all cortex has been removed from the artifact. Several Stage IV bifaces appear to have been manufactured from flakes. Pressure retouch along blade margins is common; some specimens have occasionally been pressure-flaked on one or both faces. While significant decreases in the mean width from Stage III to Stage IV bifaces were not observed, the length of Stage IV bifaces is only one-half the length of those in Stage III. However, thickness decreases by approximately 30% (Table 7.10).

Stage IV bifaces include medial and distal portions of projectile points, knives, possible drills, and preforms of these artifact types. However, the lack of hafting elements or other specialized attributes makes further classifiction into a specific functional category risky. Stage IV bifaces account for nearly 47% of the classifed biface sample and appear to represent items which were broken during manufacture and/or were rejected. Quite likely, some specimens also broke during use.

The preceding description has presented a broad outline of biface reduction processes observed in the analyzed sample. However, it should be emphasized that the collection is based on a wide variety of material types and artifacts collected from numerous archaeological sites in the Wupatki region. The vast majority of the sites in this study are represented by only a single biface. While a cross tabulation of the biface types by temporal period was performed, distinct, patterned differences could not be detected. This is largely due to differing sample sizes and to the fact that approximately 95% of the bifaces are from sites attributable to the Pueblo II and Pueblo III periods and sites of unknown origin. For a detailed picture of biface reduction technologies in the Wupatki

TABLE 7.10. Summary and Description of Bifaces.

Biface Attributes	Biface Stage			
	I (N=9)	II (N=19)	III (N=44)	IV (N=57)
Mean Length (cm)	7.05	4.58	5.24	2.43
Mean Width (cm)	4.08	2.80	2.54	1.97
Mean Thickness (cm)	2.01	0.92	0.64	0.46
Mean Thickness to Width Ratio	1:2	1:3	1:4	1:4
Percent Incomplete Specimens	33%	61%	75%	96.5%

region to emerge, synchronic site-specific analyses will need to be conducted.

Unifaces

Unifaces are artifacts that exhibit deliberate shaping/flaking along a portion of their margins on either their dorsal or their ventral surfaces. Depending upon the position of retouch, tnifaces are traditionally referred to as side scrapers or end scrapers. Unifaces are inferred to have been employed in the scraping of hides, wood, and vegetal materials. They often exhibit small, short flake scars within the immediate vicinity (2-3 mm) of an edge--sometimes on both ventral and dorsal surfaces--that may be attibutable to use-wear (Wilmsen and Roberts 1978:70).

Nineteen unifaces were identified in the Wupatki collection (Fig. 7.49,d-i), many of which appear to have been produced on thick flakes struck from cobbles procured from active river channel/old terrace deposits (47.3% retain a river-worn cortex). Material preferences for unifaces appear similar to all other categories, with cherts (N = 6), obsidian (N = 6), and agate (N = 4) accounting for over 84% of the artifacts. These are followed in frequency by basalt, chalcedony, and quartzite (all represented by one specimen each). Because the uniface collection of 19 artifacts is derived from a sample of 18 sites, any material preference or use patterns, on either a synchronic or diachronic basis, could not be detected.

Specialized Bifaces and Unifaces

This class of artifacts consists of several unique types of artifacts possessing hafting elements, modified projections, or highly stylized forms/shaped margins. Based on these attributes, a total of 39 items have been classified into functional categories, including scrapers (N = 2), drills/perforators (N = 19), burins/gravers (N = 6), denticulates (N = 2), hafted knives (N = 3), spokeshaves, and other multipurpose tools (Figs. 7.48 and 7.49).

At only one site were more than one of these specialized tools recovered; all others (N = 33) are single items recovered from a single site. Consequently, distinct temporal patterns are difficult to discern among these artifact types. Approximately one-half of the items appear to have been produced from flake blanks derived largely from local lithic materials. While the items within this classification were probably used in a wide variety of tasks, the extremely small sample size recovered at any one site precludes the formulation of significant conclusions.

Utilized and Slightly Retouched Flakes

Utilized flakes are flakes that do not exhibit evidence of deliberate shaping but do show edge damage in the removal of small short flakes, step fracture, crushing, and or polish along flake margins.

Admittedly, the types of edge damage used here are limited to those which can be detected macroscopically. Thus, the intensity of wear patterns are considered "pronounced" rather than "moderate" or "light." The latter use-wear patterns are generally detectable only under magnification (Ahler 1979). Consequently, many flakes that were used aboriginally for cutting soft materials but do not exhibit pronounced edge damage may be included in the debitage sample.

A total of 99 used flakes were identified in the Wupatki flaked lithic artifact collection. Cherts account for 32% of the utilized

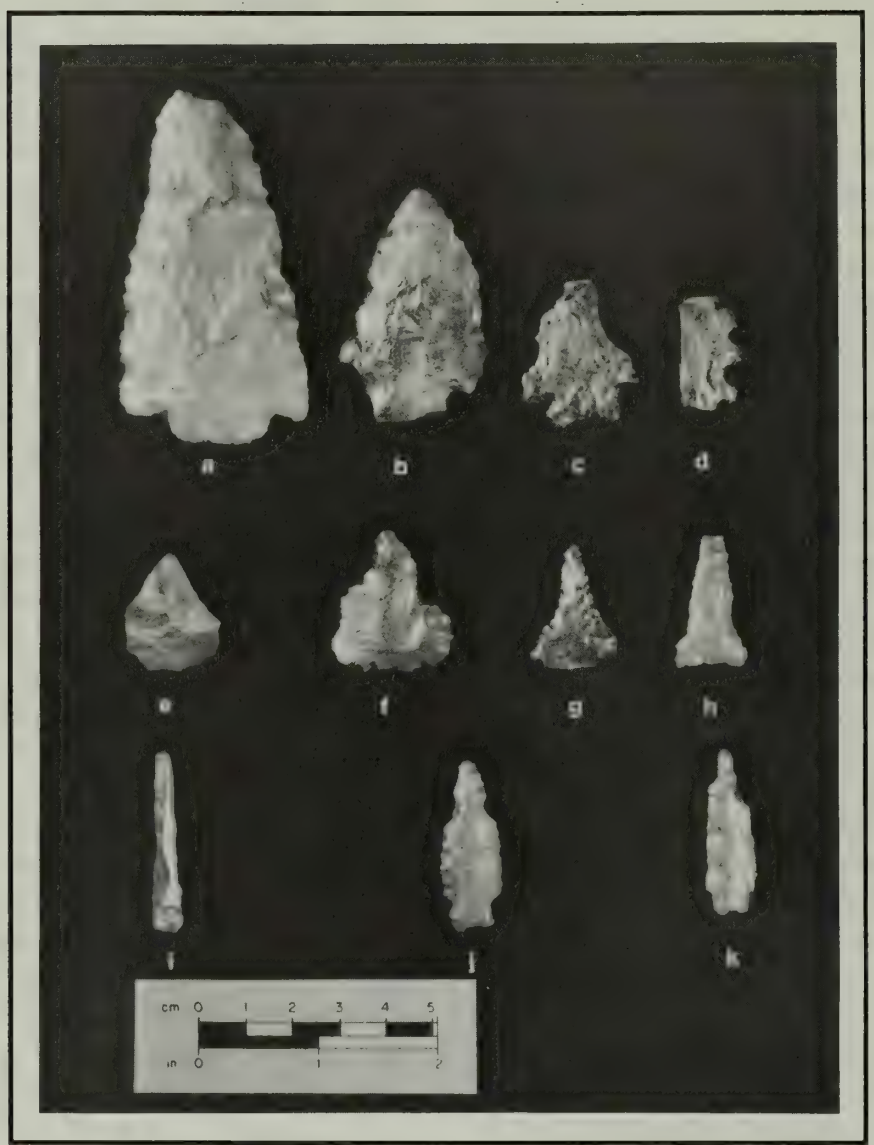


FIGURE 7.48. Specialized bifaces. a-b, hafted knives: a, WS-448; b, WS-182.18. c, spokeshave: c, WS-2036. d, denticulate: d, WS-912. e-k, drills: e, WS-2036; f, WS-1630; g, WS-777; h, WS-2163; i, WS-1974; j, WS-2445; k, WS-2420.

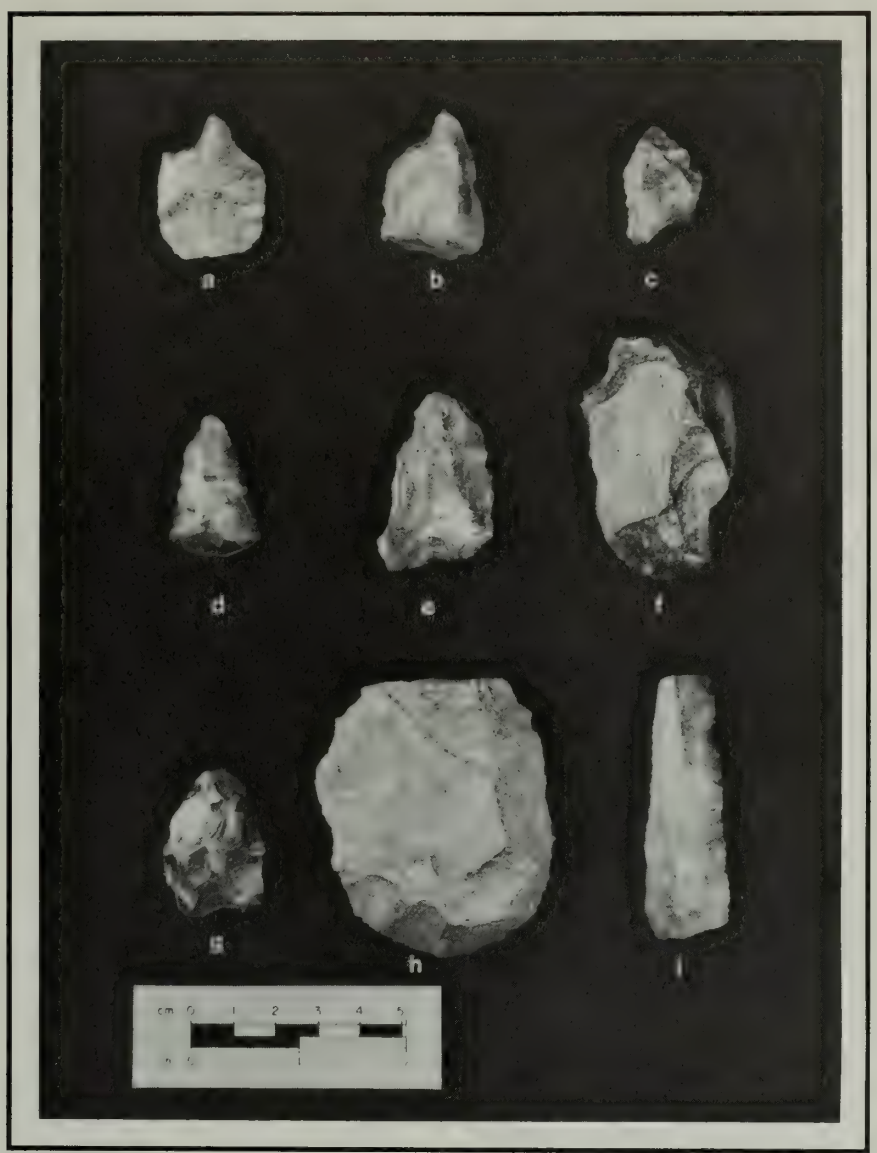


FIGURE 7.49. Gravers and unifaces. a-c, gravers: a, WS-1630; b WS-1132; c, WS-1630. d-i, unifaces: d, WS-2349; e, WS-184.2; f, WS-75.8; g, WS-237.1; h, WS-1583; i, WS-2658.

flake sample, followed in order by obsidian (27%), chalcedony (9%), basalt (8%), agate (8%), quartzite (7%), and several other material types (all comprising less than 3% each). Approximately 50% of the utilized flakes retain cortex of a fluvial origin on their dorsal surfaces. It is perhaps important to note that over 80% of the utilized obsidian flakes exhibit damage on two or more edges; in contrast, only 28% of the chert flakes exhibit damage on two or more edges. Because of its nonlocal availability and sharper edges, obsidian may have been more heavily curated than other material types. Locally available cherts appear to have been used for a short periods in a variety of scraping tasks and then discarded when edges became dull.

Flaked Lithic Cores

Cores are masses of lithic material often preformed by the flintknapper to supply flakes for tools or, by further reduction, to be fashioned into other usable tools (Crabtree 1972:43-46). A total of 104 flaked lithic cores were identified within the Wupatki collection (Fig. 7.50).

As a reflection of their local availability, cherts account for over one-half (56.7%) of all cores; all other material types were represented in percentages of less than 9%. These include quartzite (8.6%), agate (6.7%), obsidian (6.7%), chalcedony (4.8%), and eight other material types (each represented by four or fewer specimens each).

Over 82% of the cores retain cortex; cortical surfaces of a fluvial origin are present on 73% of all cores, suggesting procurement from active river channel and ancient terrace deposits, probably those of the Little Colorado River. Local availability of cherts, quartzites, and agate is also suggested by relatively high mean core weights for these material types--69.5, 99.9, and 74.5 g, respectively. However, all obsidian cores in the collection retain cortex on portions of their surfaces and are characterized by low mean core weights (5.7 g), which suggests that much of the obsidian in the Wupatki area arrived as raw and slightly reduced small cobbles and pebbles.

Debitage

Debitage is residual lithic material resulting from the manufacture of stone tools and the reduction of cores for usable flakes. Since variations in the processes of tool manufacture are as important to our understanding of extinct cultural systems as the variations in the tools themselves, debitage is potentially a very informative artifact category (Binford and Quimby 1963:346-347; Crabtree 1972:58).

A total of 2,339 pieces of lithic debitage were identified in the collection. Because debitage accounts for approximately 70% of the Wupatki flaked lithic artifact assemblage, something more than a cursory examination was necessary. Using a debitage classification procedure that has been applied to archaeological collections in east-central Arizona (Sullivan and Rozen 1985), all identified debitage was sorted into one of four flakes categories. These include complete flakes (intact striking platforms, intact margins), broken flakes (proximal flake fragments with intact striking platforms), flake fragments (distal and medial portions of flakes), or debris (flakes with undiscernible ventral or dorsal surfaces). Additionally, data were compiled on two attributes of the striking platform--the presence or absence of platform preparation and platform lipping (potentally useful in distinquishing the use of soft vs. hard

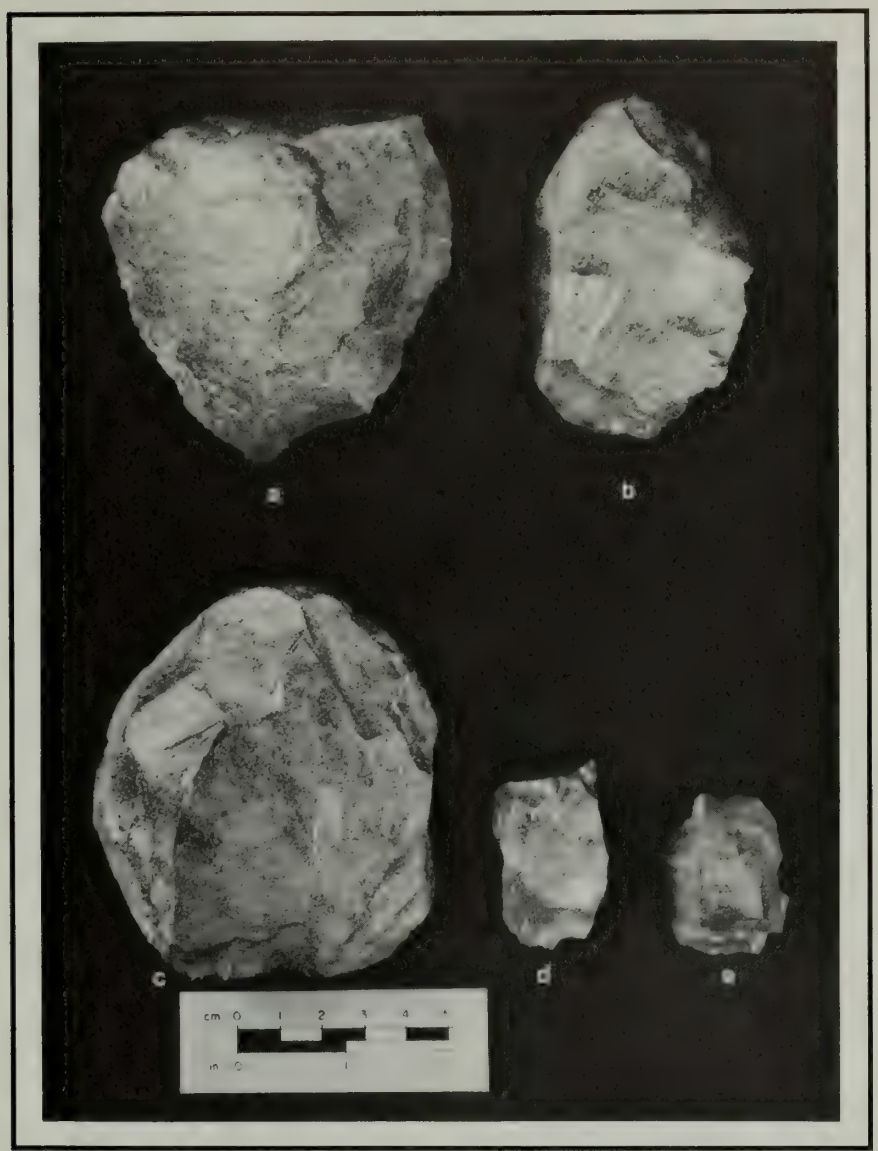


FIGURE 7.50. Flaked lithic cores. a-e, cores: a, WS-2308; b,WS-1528; c, WS-1998; d, WS-1635; e, WS-2122.

percussors). Other debitage data which were gathered included flake weight, evidence of thermal pretreatment, material type, and the presence of cortex (estimated in 10% increments).

Because a thorough description and discussion of the methods and results used are presented elsewhere, they will only be briefly summarized here. Based on differences in the four debitage categories and other flake attributes, Sullivan and Rozen (1985) identified three fairly distinct but broadly defined lithic reduction techonologies. In brief, assemblages weighted towards high numbers of complete flakes, cores, and cortical flakes characterized lithic resource quarry/lithic resource areas. At the opposite end of the spectrum, tool-manufacturing assemblages contained relatively high proportions of broken flakes, flake fragments, and retouched pieces and low numbers of cortical flakes. Assemblages situated between these two were interpreted as resulting from mixtures of core reduction and tool manufacture. Application of this model revealed technological differences between Archaic Formative age sites (Sullivan and Rozen 1985).

The percentages of the four flake types by the most frequently occurring raw material types in the Wupatki collection are presented in Table 7.11. While it should be kept in mind that these are grouped data from several sites of varying sample size, the overall proportions of these flake types for all material types (and inferred reduction technologies) appear relatively homogeneous. All are characterized by relatively high frequencies of complete flakes, flake fragments, and, with the exception of obsidian, high mean flake weights. The high percentage of cortical flakes and low mean flake weight for obsidian suggests that small obsidian pebbles and cobbles were transported to Wupatki without significant prior reduction. For other material types, though, the initial reduction of raw cobbles can be expected to produce a large number of heavy, thick, and cortex-covered flakes. The thickness of these flakes makes

TABLE 7.11. Summary of Debitage by Raw Material Type.

Debitage Attributes	Raw Material Type				
	Chert (N=1,019)	Quartzite (N=377)	Basalt (N=260)	Obsidian (N=200)	Chalcedony (N=148)
% Complete flakes	53.3	49.6	43.5	48.0	52.0
% Broken flakes	7.0	9.0	7.7	4.5	4.1
% Flake fragments	22.6	26.5	35.4	28.5	29.1
% Debris	17.2	14.3	13.5	19.0	14.9
$\bar{x}$ Flake weight (g)	9.6	14.0	12.3	2.4	13.6
% Cortical flakes	53.5	52.5	28.1	69.0	27.0
% Flakes with prepared platforms[a]	15.9	12.2	13.8	14.0	16.2
% Flakes with lipped platforms[a]	1.3	1.3	3.1	0.0	0.7

[a]Percentage figure based on total number of flakes

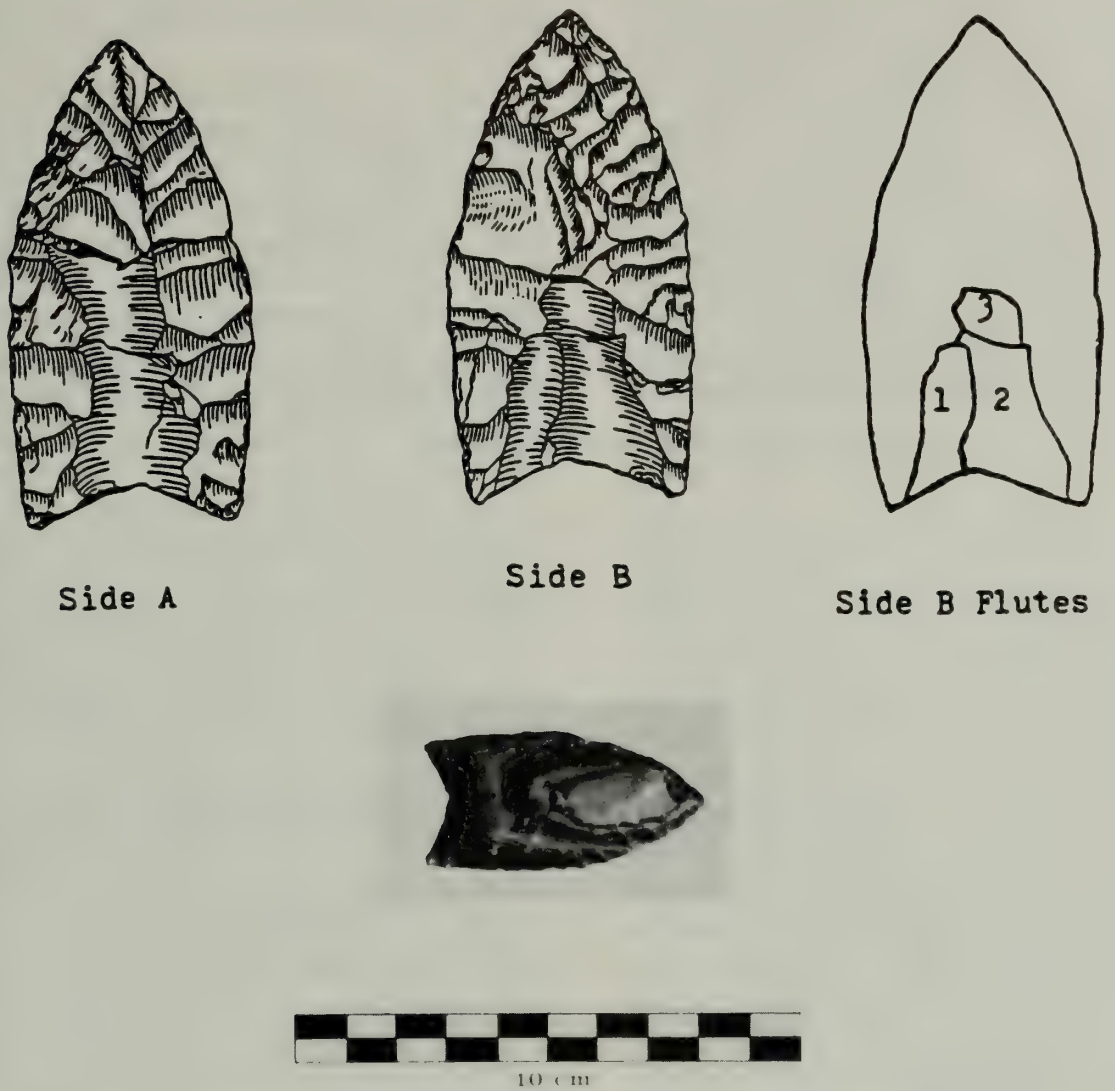


FIGURE 7.51. Gray Banded Chert Clovis Point. Weight: 13.235g.; Maximum Length: 55.35 mm.; Maximum Width: 27.68 mm; Maximum Thickness: 8.84 mm.; Width at Base: 25.23 mm.; Depth of Basal Concavity: 4.34 mm.; Length of Flute, Side A: 28.30 mm; Maximum Width of Flute, Side A: 12.18 mm.; Length of Flute 1, Side B:69 mm.; Length of Flute 2, Side B: 16.67 mm.; Maximum Width of Flute 2, Side B: 9.18 mm.; Length of Flute 3, Side B: 21.33 mm.; maximum Width of Flute 3, Side B: 7.90 mm.; Length of Edge Grinding, Left Side, Side A: 20.78 mm., begins at Base; Length of Edge Grinding, Right Side, Side A: 27.88 mm., begins at Base.

them less susceptible to breakage; hence, high percentages of complete flakes can be expected. Evidence for platform preparation and the production of platform lips more commonly associated with soft-hammer percussion techniques are generally lacking during initial reduction stages. In brief, the overall grouped data tentatively suggest that unintensive core reduction strategies extensively utilizing locally available raw materials obtained from terrace and other gravel deposits, were the dominant lithic technology employed during the Puebloan period in the Wupatki Basin.

This is obviously a broad generalization. The use of grouped data from several sites of varying sizes, age, and function clearly places severe limits on the application of these interpretations to specific sites. To more fully investigate lithic reduction processes as revealed in the collected debitage sample, artifact assemblage data from 10 sites were anaylzed more thorough-

TABLE 7.12. Technological Summary of Several Selected Sites.

		Flaked Lithic Artifact Summary									
Site No.	Cultural Affiliation and Site Description	% Complete Flakes	% Broken Flakes	% Flake Fragments	% Debris	% Retouched Pieces	% Cores	% Prepared Platforms	% Platform Lipping	$\bar{x}$ Flake Weight (g)	% Cortical Flakes
WS 933 (N=45)	PII-PIII, cluster of 7 one-room structures	24.4	4.4	55.5	13.3	2.2	0.0	9.0	0.0	4.0	18.1
	Technological generalizations: Overall, this assemblage appears most similar to tool manufacturing assemblages. However, the lack of platform lips on the analyzed specimens suggests that tools were produced with hard hammers.										
WS 1042 (N=68)	PII-PIII, small pueblo	57.3	10.2	19.1	7.4	0.0	5.9	18.7	4.7	13.0	67.1
	Technological generalizations: The percentages of flake types, cores, and cortical flakes and the high mean flake weight are strongly suggestive of unintensive core reduction. Curiously, the high frequency of platform lipping is indicative of soft-hammer percussion whereas unintensive core reduction could reasonably be expected to show more evidence of hard-hammer percussion techniques. Raw material hardness, texture, and brittleness could account for this apparent anomaly.										
WS 1132 (N=49)	PII-PIII, pueblo with 6 rooms, kiva and plaza	53.0	12.2	28.6	4.1	2.0	0.0	12.5	4.2	6.0	50.0
	Technological generalizations: Unintensive core reduction and limited tool manufacture.										
WS 1771 (N=86)	PII-PIII, 5-6 rooms in 2 structural components	47.6	4.6	23.2	13.9	0.0	10.5	5.1	1.3	12.3	49.3
	Technological generalizations: Unintensive core reduction using locally available (?) materials.										
WS 1864 (N=41)	PII-PIII, 1 storage room, 2 field structures, 1 possible depression	46.3	14.6	17.0	19.5	0.0	2.4	20.0	2.5	4.4	57. 5
	Technological generalizations: Unintensive core reduction using locally abailable (?) materials.										
WS 1027 (N=49)	PIII, pueblo	55.1	0.0	20.4	24.4	0.0	0.0	20.4	0.0	3.0	55 .1
	Technological generalizations: Unintensive and possibly a mixture of some intensive core reduction strategies using materials available in the local environment.										
WS 1111 (N-71)	PIII, 5-room unit pueblo with plaza	53.5	11.3	21.1	11.3	2.8	0.0	28.8	1.9	5.6	4 7.8
	Technological generalizations: Unintensive core reduction using locally available (?) materials with the production of a few tools, most likely from large thick flakes.										
WS 1395 (N=58)	PIII, unit pueblo, 7 rooms with plaza	39.6	6.9	27.6	19.0	1.7	5.2	22.2	0.0	3.7	24.0
	Technological generalizations: Mixture of intensive core reduction and tool manufacture. The relative lower percentage of cortical flakes suggests either that blanks were "roughed out" near source areas prior to transport and/or cores were more intensively reduced.										
WS 1630 (N=204)	PIII, 3 rooms, 2 plazas, kiva depression and associated features	54.9	9.8	17.1	10.7	4.4	2.4	15.8	1.0	6.4	53. 4
	Technological generalizations: Unintensive core reduction of locally (?) available materials and limited tool manufacture. Bifacial tools may have been produced from flake blanks.										
WS 1806 (N=140)	PIII, multi-room pueblo of detached rooms and 2 plaza areas	52.1	8.6	22.1	10.7	0.0	6.4	16.0	0.7	7.5	52.6
	Technological generalizations: Unintensive core reduction of locally available (?) materials.										

ly (Table 7.12). The single criterion used for selecting these sites was that the collected sample contain 40 or more artifacts: fewer than 40 was believed to be too small a sample to reliably evaluate general technological patterns. Consequently, the selected sample consists of 10 sites attributable to the Pueblo III and Pueblo II-III periods.

The data from these 10 sites are generally supportive of the broad unintensive core reduction patterns observed in the grouped raw material data. However, evidence for tool manufacture was obtained at one site (WS-933), while evidence for mixtures of core reduction and limited bifacial tool manufacture was obtained from at least four other sites (Table 7.12). Technological interpretations presented in Table 7.12 should be viewed with extreme caution. All data are based on surface artifacts collected according to sampling strategies described elsewhere in this volume. The a priori assumption in this analysis has been that the flaked lithic artifact sample should be treated as if it were indeed representative of each site's "sampling universe." It was further assumed that the collected sites are representative of the range of site variation within the Wupatki Basin. However, the use of surface artifacts to draw technological inferences can be affected by artifact reuse, edge trampling, and variations in collection techniques by field crew members. Thus, the generalizations presented in Table 7.12 should be viewed as testable hypotheses rather than substantiated fact.

Summary and Conclusions

As with any interpretation of archaeological phenomena, the nature and limitations of the analyzed data must be realized. The analyzed assemblage here contains a total of 3,304 items, which were surface collected from approximately 400 or 15% of the 2,668 archaeological sites documented within Wupatki National Monument between 1981 and 1987. Two limiting factors need to be emphasized regarding this collection. First, all analyzed artifacts were surface collected; although ceramic and architectural seriation has defined the temporal range of occupation of many sites within relatively tight parameters, the problem of artifact reuse by later populations and the mixing of artifacts from distinct temporal units are important considerations in the analysis of any surface collection. While this does not negate the use of surface artifacts in establishing temporal controls, such limitations must be taken into account. Second, and as important, the vast majority of sites included within the Wupatki sample are represented by fewer that 10 artifacts per site. Clearly, interpretations based on such small artifact assemblages have only limited applications, and interpretations presented in this study were consequently confined to those topics which could reasonably be addressed by the data.

This study as attempted (1) to provide basic descriptive data on the flaked lithic artifact assemblage from Wupatki National Monument; (2) to elucidate general technological patterns as revealed in the collected sample; and (3) to morphologically describe the projectile point types included within the collection. In this final section, the results of this study will be summarized and potential avenues for further research pointed out.

Macroscopic examination of raw materials included in the collection and the high frequency of cortical flakes at archaeological sites suggest that the prehistoric occupants of the Wupatki region had relatively easy access to a wide variety of

lithic materials. Archaeological surveys of the Wupatki area by Anderson (1981, 1982) indicate that good quality, highly flakeable cherts, quartzites, and silicified woods are relatively abundant on large alluvial terraces above the Little Colorado River in the eastern portion of the Monument. In her investigations of archaeological remains on these terraces, Bartlett (1943) documented a stone tool industry which she referred to as the "Tolchaco Focus." This was characterized by large numbers of bifaces, scrapers, hand axes, utilized flakes, and a lack of dart or arrow points. While no absolute dates were obtained, these assemblages were believed to predate the Formative Stage in the region (Bartlett 1943).

These quarries or lithic resource areas represent the optimal places to begin a study of lithic production systems in the Wupatki area. While it appears that much of the raw lithic material for stone tools in the Wupatki region were derived from these terrace deposits, detailed petrographic analyses and material-specific technological analyses are necessary first steps in correlating archaeological specimens with their geologic source and understanding lithic technology in the area. Similarly, obsidian artifacts need to be chemically characterized to aid in our understanding of lithic procurement and exchange networks in the region.

Projectile points in the collection are a highly diverse class of artifacts. While the association of many of these point types at ceramically and architecturally dated sites is probably indicative of their temporal occurrence at Wupatki, a large body of projectile point data from excavated and well-dated contexts is needed for us to fully understand the evolution of certain point styles in the area. In addition, the analysis of excavated artifact assemblages from well-defined temporal components, in conjunction with subsistence-related data, would be a significant contribution to our understanding of adaptive responses in the Wupatki region.

The analysis of debitage has revealed some general lithic technological trends within the Wupatki region. Generally speaking, the dominant reduction strategies appear to have been characterized by unintensive core reduction of locally procured stone. However, it is necessary to point out that the analyzed sample from any one site is relatively small and comprised totally of surface artifacts. Due to the nature and relatively small size of the analyzed samples, it was not possible to more precisely examine lithic reduction strategies. Conducting material-specific technological analyses at a synchronic level would be extremely valuable to furthering our understanding of the lithic production system at Wupatki. Clearly this analysis represents a limited study of flaked lithic artifacts, lithic technology, and artifact variation within Wupatki National Monument, but hopefully it has raised questions which can be addressed by future research.

CHAPTER 8:

CERAMICS

By MICHAEL B. STANISLAWSKI

This chapter does not intend to test hypotheses concerning ceramics, many of which are analyzed in the following chapters, but rather simply to present and briefly discuss an 80% sample of the pottery collected during the Wupatki National Monument Survey. Discussion involves the patterns of the data, their variations and anomalies, and suggestions concerning their meaning.

Archeologists love pottery, of course. While almost indestructible as a fired material, individual vessels do break. Thus ceramic bowls, jars, and vases must frequently be replaced, and as with any handmade object, slight variations occur during the production of each piece. Over time, these accidental variations may accumulate in the potterymaking traditions of the local group, and major changes may ultimately result. Thus while the fired clay material may be eternal, and at any one period the local potterymaking techniques, vessel forms, and decoration styles look stable, they actually are always changing. The passing of time and associated generational changes, accidental changes (mutations), and random variations (cultural drift) may be the only factors; or change may occur because of local innovations by respected potters, which are then copied (invention and social selection). Moreover, whenever two groups of different people get together, they tend to exchange ideas as well as goods. These intercultural contacts also produce change (diffusion and cultural hybridization).

The assumption is that these ever-changing pottery traditions mirror at least some of the changing patterns of culture over time. These changes, which can be correlated with specific time periods and cultural groups, make pottery extremely important to the archeologist: by the study of broken pots, a few of the traditions that mirror the presence of a people long gone may be dimly perceived. The minimum value of any ceramic survey collection, then,

is its utility in providing accurate temporal and cultural placement of associated sites, as well as in understanding the patterns of trade and intercultural relationships of prehistoric peoples.

The framework for our discussion is: (1) definition of pottery wares and types found at the Monument and problems associated with their analysis; (2) discussion of the whole pots and groups of ceramic artifacts in the collections; (3) identification of the cultural groups and time periods represented at the Monument; (4) discussion of the contributions of the ceramic survey to the understanding of the demography of the Monument area; (5) discussion of the similarities and differences of pottery collections made at excavated as compared to surveyed sites; and (6) comments on the problem of using percentage figures based upon weight, as compared to the use of figures based upon count.

Data

The data at hand were gathered during seven summers of archeological survey of every section, township, and range of Wupatki National Monument, northeastern Arizona. The collection includes about 25,000 catalogued sherds of at least 8 possibly local ceramic wares, 48 types, and 4-5 foreign or trade varieties. The most abundant of these types is Moenkopi Corrugated, including nearly 3,900 sherds, about 19% of the total collection. On the other hand, rare decorated types such as Kana'a Black-on-white and Kayenta Black-on-white comprise only a handful of sherds and do not even register at three decimal places in the statistics. This report does not discuss all of the sites, most of which had only a few sherds, but a complete list of the sites and their periods of occupation can be found in the chapter by Downum and Sullivan (this volume). The sherd counts and percentages are available on laboratory sheets at the Southwest Cultural Resources Center of the National Park Service, Santa Fe.

The emphasis of this report will be on the 67 sites that had 100 or more sherds, or 80% (20,506 sherds) of the pottery of the Monument survey. Not only does this part of the collection provide us a more reliable set of statistical data, but nearly all of the 67 are larger sites that were gridded and completely collected within selected units of this grid, giving a reliable sample. In short, these sites are among those most carefully collected and offer the best insights on settlement dates and cultural affiliations. Just two of the sites (WS 1630 and WS 1806) produced 24% of the pottery collected during the survey!

Finally, any and all rare and particularly interesting pottery types found at any sites during the survey will be included in the early discussions as well.

Method and Problems of Analysis

The field-catalogued specimens were first washed, bagged, and catalogued to registration level. I then began my work by separating the sherds by surface decoration into plain ware and decorated wares, by background color or slip into wares, and finally into type categories using the classification guides of Colton (1941, 1946a, 1955, 1956, 1958), Colton and Hargrave (1937), Smith (1952; 1971), and Gifford and Smith (1978). The type collections of the Laboratory of Anthropology, Santa Fe, were also utilized as comparative sources. Dates are based on a modified version of Colton's concept of ceramic periods, using both plain ware and decorated types (1946), as fol-

lowed in this volume by Downum and Sullivan. These authors list the pottery types involved in the creation of the periods, but only Periods 2-5 are actually used in the survey data reported here, with the exception of one post-Sinagua Hopi pot-drop, ca. A.D. 1300. The dates of some types were also modified using the work of Breternitz (1966) and correlated with the more recent work of Robinson et al. (1975).

Artifacts made of sherds were noted (mainly discs, whorls, pendants, and handle fragments), and the sherds of each type were subdivided into rim and body units, and vessel form units (i.e., jars and bowls). Each unit was then counted, weighed in grams, and percentaged in the study of the collections of the first three or four survey phases, but only counted during the analysis of the last phase units. Finally, all individual site grid unit sheets of sites having more than 100 sherds were summarized on one site total sheet, and the master table (Table 1), including 67 sites and 20,506 sherds, was prepared. Table 2, summarizing a sample of 12 previously excavated and reported Monument area sites, was then constructed, including 55,656 sherds of 8 wares and 44 types, and these totals were printed next to those of the surveyed sites (Table 1), thus forming Table 3. Finally, Table 4 was compiled, including the inferred culture groups and time periods as correlated with the 67 sampled sites, thus summarizing the temporal and cultural periods of occupation.

To briefly highlight the information contained in these tables, I suggest that Wupatki National Monument ceramic wares and types break down into eight major local wares and five trade types or wares, with 20,506 total sherds included in the 67 site collections of more than 100 sherds each. These 24 plain ware and 24 decorated types comprise a plain ware industry of 13,097 sherds, or 64% of the total; and a decorated ware industry of 7,409 sherds, or 36% of the total sample of sherds. Each category was then subdivided into its major ceramic wares. Decorated wares included Tusayan White (3,897, or 19%), Little Colorado White (2,785, or 14%), Tsegi Orange (709, or 3.5%), and three other minor or trade wares, totaling 18 sherds. The plain ware was subdivided into four major wares--Tusayan Gray (8,256, or 40%), Alameda Brown (3,510, or 17%), San Francisco Mountain Gray (530, or 2.5%), and Prescott Gray (462, or 2%), as well as three minor trade ware types and an "unknown" category, totaling some 339 sherds, or about 1.5%.

Two methodological problems should be noted. First, the field inventory was done by a number of different people, and the final analysis and classification was done by two or three people, including Downum (some 10,500 sherds in 23 of our 67 sites) and Stanislawski (some 10,000 sherds in 44 of our 67 sites). About 5,000 other sherds were analyzed by Stanislawski from the remaining ceramic sites found during survey, but only the more rare and interesting examples of these will be mentioned here. Second, even the decorated types, which are the most sensitive indicators of temporal and cultural distinctions and the most easily classified, have problems of dating, identification of areas of actual origin, and classification.

Colton's published dates were revised by Breternitz (1966) based upon some 5,700 tree-ring specimens from 340 sites with the pottery types, a dozen of which are from the Flagstaff area. However, his date ranges for most types are very broad and depend upon whether the type specimen is local or foreign (another problem, as we shall see); and his dates, in any case, will have to be revised again, based upon the new tree-ring analysis of Robinson et al. (1975).

TABLE 8.1. Wupatki ceramic survey.

WPS Number MNA Number	WS 36 17004		WS 37 17005		WS 100 17065		WS 112 17077		WS 157 343	
	No. of Sherds	Percent	No. of Sherds	Percent	No. of Sherds	Percent	No. of Sherds	Percent	No. of Sherds	Percent
Painted Pottery	90	0.41	47	0.44	65	0.46	109	0.41	57	0.36
Tusayan Whiteware	21	0.10	32	0.29	17	0.12	37	0.14	12	0.08
Kana B/w										
Black Mesa B/w							2	0.01	1	0.01
Shato B/w										
Dogoszhi B/w			14	0.13	1	0.01	3	0.01		
Sosi B/w	2	0.01			5	0.04	4	0.02		
Flagstaff B/w	7	0.07	9	0.08	2	0.01	11	0.04	1	0.01
Wupatki B/w	1	t								
Tusayan B/w										
Tusayan/Wupatki B/w										
Kayenta B/w										
Polacca B/w										
Kia'Ko B/w										
Betatakin B/w										
Unidentified	11	0.05	9	0.08	9	0.06	17	0.06	10	0.06
Little Colorado Whiteware	61	0.28	7	0.07	31	0.22	67	0.25	41	0.26
Holbrook B/w	11	0.05	2	0.02	5	0.04	12	0.05		
Padre B/w	1	t			1	0.01	2	0.01		
Chevelon B/w										
Walnut B/w	35	0.16			10	0.07	39	0.15	13	0.08
Leupp B/w					2	0.01				
Unidentified	14	0.06	5	0.04	13	0.09	14	0.05	28	0.18
Tsegi Orangeware	8	0.04	8	0.08	17	0.12	5	0.02	4	0.03
Medicine B/r										
Tusayan B/r			2	0.02	1	0.01				
Cameron Polychrome										
Citadel Polychrome			2	0.02	2	0.01	1			
Tusayan Polychrome	3	0.01								
Citadel/Tusayan A Poly.							3	0.01		
Tsegi B/o										
Tsegie B/o										
Tsegie Polychrome										
Unidentified	5	0.02	4	0.04	14	0.10	1		4	0.03
Other Trade Types										
Tuzigoot White/red										
Cibola Whiteware										
St. John's Polychrome										
Unknown wares										
Plainware	128	0.59	63	0.56	77	0.54	155	0.59	102	0.64
Tusayan Grayware	106	0.49	26	0.24	52	0.37	90	0.34	32	0.20
O'Leary Tooled										
Honani Tooled					1	0.01				
Medicine Gray										
Tusayan Corrugated	11	0.05			12	0.08	13	0.05	2	0.01
Moenkopi Corrugated	88	0.40	26	0.24	39	0.27	75	0.28	30	0.19
Deadman's Corrugated										
Keam's Corrugated										
Little Colorado Corrugated							2	0.01		
Unidentified	7	0.03								
Alameda Brownware	14	0.06	36	0.32	6	0.04	50	0.19	47	0.30
Rio de Flag Brown										
Win/Ang/Youngs Brown	5	0.02	22	0.20			17	0.06	14	0.09
Sunset Red/brown	9	0.02	7	0.06	6	0.04	27	0.10	11	0.07
Sunset Plain										
Turkey Hill Red							4	0.02		
Verde Brown			7	0.06			2	0.01	18	0.11
Winona Red									4	0.03
Unidentified										
San Francisco Mt. Grayware	7	0.03	1	0.01	19	0.13	15	0.06	15	0.09
Deadmans Gray			1	0.01	9	0.06	13	0.05	11	0.07
Deadmans Fugitive Red	2	0.01			10	0.07	2	0.01	4	0.03
Deadmans B/g	5	0.02								
Prescott Grayware	1	0.00							7	0.04
Prescott Gray/orange	1								1	0.01
Prescott B/g									6	0.04
Other Plainware										
Elden Corrugated										
Winona Corrugated										
Unknown Brown/Gray ware									1	0.01
Hopi Yellowwares										
Jeddito Plain										
Jeddito Corrugated										
Final Site Count	218		110		142		264		159	

TABLE 8.1. (continued)

WPS Number MNA Number	WS 165 2876		WS 182 17119		WS 204 17129		WS 224 17146		WS 249 654	
	No. of Sherds	Percent	No. of Sherds	Percent	No. of Sherds	Percent	No. of Sherds	Percent	No. of Sherds	Percent
Painted Pottery	82	0.62	114	0.60			65	0.56	116	0.47
Tusayan Whiteware	24	0.18	51	0.27			41	0.35	59	0.24
Kana B/w										
Black Mesa B/w							4	0.03		
Shato B/w										
Dogoszhi B/w	5	0.04	7	0.04					9	0.04
Sosi B/w							1	0.01	3	0.01
Flagstaff B/w	5	0.04	11	0.06			8	0.07	8	0.03
Wupatki B/w			1	0.01			2	0.02		
Tusayan B/w							26	0.22		
Tusayan/Wupatki B/w										
Kayenta B/w										
Polacca B/w										
Kia'Ko B/w										
Betatakin B/w										
Unidentified	14	0.11	32	0.17					39	0.09
Little Colorado Whiteware	58	0.44	54	0.28			23	0.20	42	0.17
Holbrook B/w	3	0.02	5	0.03			1	trace	2	trace
Padre B/w	1	0.01	1	0.01						
Chevelon B/w										
Walnut B/w	32	0.24	24	0.13					14	0.06
Leupp B/w										
Unidentified	22	0.17	23	0.12			22	0.19	26	0.11
Tsegi Orangeware			9	0.05			1	0.01	15	0.06
Medicine B/r										
Tusayan B/r									1	trace
Cameron Polychrome										
Citadel Polychrome									4	0.02
Tusayan Polychrome										
Citadel/Tusayan A Poly.										
Tsegi B/o										
Tsegie B/o										
Tsegie Polychrome										
Unidentified			9	0.05			1	0.01	10	0.04
Other Trade Types										
Tuzigoot White/red										
Cibola Whiteware										
St. John's Polychrome										
Unknown wares										
Plainware	51	0.38	77	0.40			51	0.41	132	0.53
Tusayan Grayware	22	0.17	48	0.25			33	0.23	109	0.44
O'Leary Tooled										
Honani Tooled										
Medicine Gray										
Tusayan Corrugated									7	0.03
Moenkopi Corrugated	22	0.17	47	0.25			33	0.23	102	0.41
Deadman's Corrugated										
Keam's Corrugated										
Little Colorado Corrugated										
Unidentified			1	0.01						
Alameda Brownware	15	0.11	23	0.12			15	0.13	13	0.06
Rio de Flag Brown										
Win/Ang/Youngs Brown									2	0.01
Sunset Red/brown	15	0.11	9	0.05			7	0.06	9	0.04
Sunset Plain										
Turkey Hill Red			1	0.01						
Verde Brown			13	0.07			1	trace	2	0.01
Winona Red										
Unidentified							7	0.06		
San Francisco Mt. Grayware	14	0.11	1	0.01			3	0.03	5	0.02
Deadmans Gray	8	0.06	1	0.01			3	0.03	4	0.02
Deadmans Fugitive Red	6	0.05							1	trace
Deadmans B/g										
Prescott Grayware			4	0.02					2	0.01
Prescott Gray/orange									2	0.01
Prescott B/g			4	0.02						
Other Plainware										
Elden Corrugated										
Winona Corrugated										
Unknown Brown/Gray ware			1	0.01					3	0.01
Hopi Yellowwares										
Jeddito Plain					269	100.00				
Jeddito Corrugated										
Final Site Count	133		191		269		116		248	

TABLE 8.1. (continued)

WPS Number MNA Number	WS 323 637		WS 328 17444		WS 353 17469		WS 355 625		WS 359 17474	
	No. of Sherds	Percent	No. of Sherds	Percent	No. of Sherds	Percent	No. of Sherds	Percent	No. of Sherds	Percent
Painted Pottery	39	0.39	36	0.23	24	0.17	77	0.49	23	0.22
Tusayan Whiteware	10	0.10	18	0.11	6	0.04	25	0.16	9	0.09
Kana B/w										
Black Mesa B/w	1	0.01					1	trace		
Shato B/w			1	trace	1	0.01				
Dogoszhi B/w	1	0.01					1	trace		
Sosi B/w	1	0.01	4	0.03			3	0.02	1	0.01
Flagstaff B/w	1	0.01	4	0.03			4	0.03	3	0.03
Wupatki B/w										
Tusayan B/w										
Tusayan/Wupatki B/w										
Kayenta B/w										
Polacca B/w										
Kia'Ko B/w										
Betatakin B/w										
Unidentified	6	0.06	9	0.05	5	0.03	16	0.10	5	0.05
Little Colorado Whiteware	19	0.19	14	0.09	8	0.06	44	0.28	10	0.10
Holbrook B/w	2	0.02	2	0.01	1	0.01	2	0.01	7	0.07
Padre B/w	4	0.04					5	0.03		
Chevelon B/w										
Walnut B/w	6	0.06	3	0.02			10	0.06		
Leupp B/w										
Unidentified	7	0.07	9	0.05	7	0.05	27	0.18	3	0.03
Tsegi Orangeware	10	0.10	4	0.03	10	0.07	8	0.05	4	0.04
Medicine B/r										
Tusayan B/r					4	0.03	3	0.02	3	0.03
Cameron Polychrome										
Citadel Polychrome										
Tusayan Polychrome										
Citadel/Tusayan A Poly.										
Tsegi B/o										
Tsegie B/o										
Tsegie Polychrome										
Unidentified	10	0.10	4	0.03	6	0.04	5	0.03	1	0.01
Other Trade Types										
Tuzigoot White/red										
Cibola Whiteware										
St. John's Polychrome										
Unknown wares										
Plainware	60	0.60	123	0.77	117	0.83	78	0.49	84	0.80
Tusayan Grayware	54	0.54	95	0.06	25	0.18	62	0.40	59	0.56
O'Leary Tooled										
Honani Tooled										
Medicine Gray										
Tusayan Corrugated	30	0.30	51	0.32	13	0.09	38	0.25	49	0.46
Moenkopi Corrugated			40	0.25	7	0.05	24	0.15	10	0.10
Deadman's Corrugated	24	0.24								
Keam's Corrugated										
Little Colorado Corrugated										
Unidentified			4	0.03	5	0.03				
Alameda Brownware	4	0.04	16	0.10	92	0.65	4	0.02	17	0.16
Rio de Flag Brown										
Win/Ang/Youngs Brown	2	0.02	5	0.03	92	0.65	2	0.01	16	0.15
Sunset Red/brown	2	0.02	11	0.07					1	0.01
Sunset Plain										
Turkey Hill Red							2	0.01		
Verde Brown										
Winona Red										
Unidentified										
San Francisco Mt. Grayware	1	0.01	10	0.06			12	0.07	8	0.08
Deadmans Gray	1	0.01	3	0.02			10	0.06	8	0.08
Deadmans Fugitive Red			5	0.04			2	0.01		
Deadmans B/g			1	0.01						
Prescott Grayware	1	0.01	2	0.01						
Prescott Gray/orange										
Prescott B/g	1	0.01	2	0.01						
Other Plainware										
Elden Corrugated										
Winona Corrugated										
Unknown Brown/Gray ware										
Hopi Yellowwares										
Jeddito Plain										
Jeddito Corrugated										
Final Site Count	99		159		141		155		107	

TABLE 8.1. (continued)

WPS Number MNA Number	WS 404 17519		WS 459 678		WS 518 687		WS 519 1184		WS 546 17646	
	No. of Sherds	Percent	No. of Sherds	Percent	No. of Sherds	Percent	No. of Sherds	Percent	No. of Sherds	Percent
Painted Pottery	153	0.46	92	0.49	42	0.24	45	0.42	54	0.53
Tusayan Whiteware	30	0.08	23	0.12	17	0.10	9	0.09	19	0.18
Kana B/w										
Black Mesa B/w									2	0.02
Shato B/w									1	0.01
Dogoszhi B/w	4	0.01			5	0.03			3	0.03
Sosi B/w	1	trace			1	0.01			1	0.01
Flagstaff B/w	11	0.03	3	0.01			2	0.02	3	0.03
Wupatki B/w	2	trace					1	0.01		
Tusayan B/w							1	0.01		
Tusayan/Wupatki B/w										
Kayenta B/w										
Polacca B/w									1	0.01
Kia'Ko B/w									2	0.02
Betatakin B/w										
Unidentified	12	0.04	20	0.10	11	0.06	5	0.05	6	0.06
Little Colorado Whiteware	103	0.32	43	0.22	8	0.05	34	0.31	22	0.22
Holbrook B/w	3	0.01	1	t	4	0.02	5	0.05	2	0.02
Padre B/w	6	0.02	10	0.05			4	0.04	1	0.01
Chevelon B/w	1	trace			1	0.01				
Walnut B/w	49	0.15	12	0.06	1	0.01	8	0.07	6	0.06
Leupp B/w	3	0.01								
Unidentified	41	0.13	20	0.10	2	0.01	17	0.15	13	0.13
Tsegi Orangeware	20	0.06	26	0.14	17	0.10	2	0.02	13	0.13
Medicine B/r									1	0.01
Tusayan B/r			2	0.01	4	0.02	1	0.01	4	0.04
Cameron Polychrome										
Citadel Polychrome					2	0.01				
Tusayan Polychrome										
Citadel/Tusayan A Poly.										
Tsegi B/o			1	0.01						
Tsegie B/o										
Tsegie Polychrome										
Unidentified	20	0.06	23	0.12	11	0.06	1	0.01	8	0.08
Other Trade Types										
Tuzigoot White/red										
Cibola Whiteware										
St. John's Polychrome										
Unknown wares										
Plainware	176	0.52	99	0.52	134	0.77	61	0.58	50	0.48
Tusayan Grayware	123	0.37	53	0.28	79	0.45	43	0.40	22	0.22
O'Leary Tooled										
Honani Tooled										
Medicine Gray										
Tusayan Corrugated	66	0.20	23	0.12	75	0.43	31	0.29	10	0.10
Moenkopi Corrugated	52	0.16	8	0.04	4	0.02	10	0.09	1	0.01
Deadman's Corrugated										
Keam's Corrugated										
Little Colorado Corrugated										
Unidentified	5	0.01	22	0.12			2	0.02	11	0.11
Alameda Brownware	47	0.14	10	0.05	10	0.06	8	0.08	10	0.10
Rio de Flag Brown										
Win/Ang/Youngs Brown	3	0.01	8	0.04	9	0.05	3	0.03	8	0.08
Sunset Red/brown	40	0.12	2	0.01	1	0.01	3	0.03	1	0.01
Sunset Plain										
Turkey Hill Red	1	trace					2	0.02		
Verde Brown	3	0.01								
Winona Red									1	0.01
Unidentified										
San Francisco Mt. Grayware	2	trace	36	0.19	45	0.26	10	0.10	18	0.17
Deadmans Gray	2	trace	30	0.16	38	0.22	6	0.06	12	0.12
Deadmans Fugitive Red			6	0.03	6	0.03	2	0.02	6	0.06
Deadmans B/g					1	0.01	2	0.02		
Prescott Grayware	4	0.01								
Prescott Gray/orange										
Prescott B/g	4	0.01								
Other Plainware										
Elden Corrugated										
Winona Corrugated										
Unknown Brown/Gray ware										
Hopi Yellowwares										
Jeddito Plain										
Jeddito Corrugated										
Final Site Count	329		191		176		106		104	

TABLE 8.1. (continued)

WPS Number MNA Number	WS 590 17690		WS 706 17865		WS 709		WS 890		WS 892	
	No. of Sherds	Percent	No. of Sherds	Percent	No. of Sherds	Percent	No. of Sherds	Percent	No. of Sherds	Percent
Painted Pottery	70	0.61	61	0.41	150	0.99	40	0.21	19	0.19
Tusayan Whiteware	14	0.12	36	0.24	129	0.85	23	0.07	8	0.08
Kana B/w										
Black Mesa B/w	1	0.01	1	0.01						
Shato B/w										
Dogoszhi B/w	1	0.01	3	0.02	3	0.02			1	0.01
Sosi B/w			9	0.06	3	0.02	4	0.03	2	0.02
Flagstaff B/w	4	0.03	14	0.09	72	0.47	1	0.01	2	0.02
Wupatki B/w	1	0.01	2	0.01	2	0.01	14	0.12		
Tusayan B/w			1	0.01	1	0.01				
Tusayan/Wupatki B/w										
Kayenta B/w										
Polacca B/w										
Kia'Ko B/w										
Betatakin B/w										
Unidentified	7	0.06	6	0.04	48	0.32	4	0.03	3	0.03
Little Colorado Whiteware	52	0.45	13	0.09	21	0.14	14	0.12	4	0.04
Holbrook B/w	3	0.03	2	0.01	3	0.02				
Padre B/w	4	0.03			3	0.02			3	0.03
Chevelon B/w	1	0.01								
Walnut B/w	27	0.23	8	0.05	13	0.09				
Leupp B/w										
Unidentified	17	0.15	3	0.02	2	0.01	14	0.12	1	0.01
Tsegi Orangeware	4	0.04	12	0.08			2	0.02	7	0.07
Medicine B/r										
Tusayan B/r	1	0.01	7	0.05			1	0.01	2	0.02
Cameron Polychrome										
Citadel Polychrome	1	0.01	1	0.01						
Tusayan Polychrome										
Citadel/Tusayan A Poly.										
Tsegi B/o										
Tsegie B/o										
Tsegie Polychrome										
Unidentified	2	0.02	4	0.03			1	0.01	5	0.05
Other Trade Types										
Tuzigoot White/red							1	0.01		
Cibola Whiteware										
St. John's Polychrome										
Unknown wares										
Plainware	45	0.39	88	0.59	2	0.01	95	0.79	81	0.81
Tusayan Grayware	31	0.27	73	0.49	1	0.01	62	0.51	48	0.48
O'Leary Tooled										
Honani Tooled										
Medicine Gray										
Tusayan Corrugated	29	0.25	28	0.19	1	0.01	27	0.22	22	0.22
Moenkopi Corrugated	2	0.02	35	0.23			13	0.11	25	0.25
Deadman's Corrugated			10	0.07						
Keam's Corrugated										
Little Colorado Corrugated										
Unidentified							22	0.18	1	0.01
Alameda Brownware	13	0.11	9	0.06			13	0.11	3	0.03
Rio de Flag Brown										
Win/Ang/Youngs Brown	12	0.10	6	0.04			6	0.05	2	0.02
Sunset Red/brown	1	0.01	3	0.02			7	0.06	1	0.01
Sunset Plain										
Turkey Hill Red										
Verde Brown										
Winona Red										
Unidentified										
San Francisco Mt. Grayware	1	0.01	6	0.04	1	0.01	17	0.14	29	0.29
Deadmans Gray			6	0.04			11	0.09	16	0.16
Deadmans Fugitive Red	1	0.01			1	0.01	6	0.05	13	0.13
Deadmans B/g										
Prescott Grayware							3	0.02	1	0.01
Prescott Gray/orange							3	0.02	1	0.01
Prescott B/g										
Other Plainware										
Elden Corrugated										
Winona Corrugated										
Unknown Brown/Gray ware										
Hopi Yellowwares										
Jeddito Plain										
Jeddito Corrugated										
Final Site Count	115		149		152		135		100	

TABLE 8.1. (continued)

WPS Number MNA Number	WS 895 568		WS 933		WS 1023		WS 1027 633-35		WS 1042	
	No. of Sherds	Percent	No. of Sherds	Percent	No. of Sherds	Percent	No. of Sherds	Percent	No. of Sherds	Percent
Painted Pottery	30	0.27	94	0.26	44	0.17	219	0.41	95	0.65
Tusayan Whiteware	10	0.09	40	0.11	35	0.14	134	0.25	67	0.46
Kana B/w										
Black Mesa B/w			3	0.01						
Shato B/w										
Dogoszhi B/w			2	0.01						
Sosi B/w	2	0.02	20	0.06	1	0.00			1	0.01
Flagstaff B/w					7	0.03	34	0.06	23	0.16
Wupatki B/w										
Tusayan B/w							7	0.01	13	0.09
Tusayan/Wupatki B/w							2	0.00		
Kayenta B/w										
Polacca B/w										
Kia'Ko B/w			3	0.01						
Betatakin B/w										
Unidentified	8	0.07	12	0.03	27	0.11	91	0.17	30	0.20
Little Colorado Whiteware	15	0.13	29	0.08	5	0.02	82	0.15	23	0.16
Holbrook B/w			6	0.02						
Padre B/w	2	0.02					1	0.00	1	0.01
Chevelon B/w	1	0.01								
Walnut B/w	2	0.02	10	0.03			20	0.04	5	0.03
Leupp B/w										
Unidentified	10	0.09	13	0.04	5	0.02	61	0.11	17	0.12
Tsegi Orangeware	5	0.04	25	0.07	4	0.02	2	0.00	5	0.03
Medicine B/r			1	0.00						
Tusayan B/r	3	0.03	3	00.1					1	0.01
Cameron Polychrome										
Citadel Polychrome										
Tusayan Polychrome			1	0.00						
Citadel/Tusayan A Poly.										
Tsegi B/o										
Tsegie B/o										
Tsegie Polychrome										
Unidentified	2	0.02	20	0.06	4	0.02	2	0.00	4	0.03
Other Trade Types										
Tuzigoot White/red										
Cibola Whiteware							1	0.00		
St. John's Polychrome										
Unknown wares										
Plainware	83	0.73	265	0.74	213	0.83	312	0.59	52	0.35
Tusayan Grayware	62	0.55	176	0.49	189	0.74	283	0.53	42	0.29
O'Leary Tooled										
Honani Tooled										
Medicine Gray										
Tusayan Corrugated	25	0.22	89	0.25	6	0.02	16	0.03	3	0.02
Moenkopi Corrugated	22	0.19	54	0.15	152	0.59	94	0.18	20	0.14
Deadman's Corrugated										
Keam's Corrugated										
Little Colorado Corrugated					1	0.00				
Unidentified	15	0.13	33	0.09	30	0.12	173	0.33	19	0.13
Alameda Brownware	4	0.04	3	0.01	20	0.08	5	0.01	1	0.01
Rio de Flag Brown										
Win/Ang/Youngs Brown					2	0.01				
Sunset Red/brown	3	0.03	3	0.01	18	0.07	5	0.01	1	0.01
Sunset Plain										
Turkey Hill Red	1	0.01								
Verde Brown										
Winona Red										
Unidentified										
San Francisco Mt. Grayware	11	0.10	84	0.23	3	0.01			9	0.06
Deadmans Gray	3	0.03	30	0.08	3	0.01			9	0.06
Deadmans Fugitive Red	7	0.06	51	0.14						
Deadmans B/g	1	0.01	3	0.01						
Prescott Grayware	6	0.05	2	0.01			21	0.04		
Prescott Gray/orange	5	0.04	2	0.01			18	0.03		
Prescott B/g	1	0.01					3	0.01		
Other Plainware										
Elden Corrugated										
Winona Corrugated										
Unknown Brown/Gray ware					1	0.00	3	0.01		
Hopi Yellowwares										
Jeddito Plain										
Jeddito Corrugated										
Final Site Count	113		359		257		531		147	

TABLE 8.1. (continued)

WPS Number MNA Number	WS 1043 636		WS 1059		WS 1061		WS 1067		WS 1089	
	No. of Sherds	Percent	No. of Sherds	Percent	No. of Sherds	Percent	No. of Sherds	Percent	No. of Sherds	Percent
Painted Pottery	172	0.37	133	0.85	77	0.56	136	0.54	433	0.49
Tusayan Whiteware	68	0.14	93	0.60	40	0.29	109	0.43	205	0.23
Kana B/w										
Black Mesa B/w										
Shato B/w										
Dogoszhi B/w									10	0.01
Sosi B/w										
Flagstaff B/w	11	0.02	5	0.03	7	0.05	3	0.01	46	0.05
Wupatki B/w							1	0.00	3	0.00
Tusayan B/w			36	0.23	1	0.01	39	0.16	11	0.01
Tusayan/Wupatki B/w	7	0.01								
Kayenta B/w										
Polacca B/w										
Kia'Ko B/w										
Betatakin B/w										
Unidentified	50	0.11	52	0.33	32	0.23	66	0.26	135	0.15
Little Colorado Whiteware	95	0.20	37	0.24	37	0.27	26	0.10	168	0.19
Holbrook B/w					2	0.01			3	0.00
Padre B/w	3	0.01								
Chevelon B/w			1	0.01						
Walnut B/w	23	0.05	8	0.05	12	0.09	8	0.03	41	0.05
Leupp B/w										
Unidentified	69	0.15	28	0.18	23	0.17	18	0.07	124	0.14
Tsegi Orangeware	9	0.02	3	0.02			1	0.00	60	0.07
Medicine B/r										
Tusayan B/r	1	0.00							9	0.01
Cameron Polychrome										
Citadel Polychrome										
Tusayan Polychrome										
Citadel/Tusayan A Poly.										
Tsegi B/o										
Tsegie B/o										
Tsegie Polychrome										
Unidentified	8	0.02	3	0.02			1	0.00	51	0.06
Other Trade Types										
Tuzigoot White/red										
Cibola Whiteware										
St. John's Polychrome										
Unknown wares										
Plainware	298	0.63	23	0.15	61	0.44	115	0.46	452	0.51
Tusayan Grayware	285	0.61	20	0.13	56	0.41	115	0.46	333	0.38
O'Leary Tooled										
Honani Tooled									1	0.00
Medicine Gray										
Tusayan Corrugated	13	0.03							11	0.01
Moenkopi Corrugated	163	0.35	5	0.03	27	0.20	72	0.29	184	0.21
Deadman's Corrugated										
Keam's Corrugated										
Little Colorado Corrugated									3	0.00
Unidentified	109	0.23	15	0.10	29	0.21	43	0.17	134	0.15
Alameda Brownware	8	0.02	3	0.02	5	0.04			61	0.07
Rio de Flag Brown										
Win/Ang/Youngs Brown					2	0.01			24	0.03
Sunset Red/brown	7	0.01			3	0.02			37	0.04
Sunset Plain										
Turkey Hill Red										
Verde Brown										
Winona Red										
Unidentified	1	0.00	3	0.02						
San Francisco Mt. Grayware									3	0.00
Deadmans Gray									2	0.00
Deadmans Fugitive Red										
Deadmans B/g									1	0.00
Prescott Grayware	5	0.01							48	0.05
Prescott Gray/orange	1	0.00							40	0.05
Prescott B/g	4	0.01							8	0.01
Other Plainware										
Elden Corrugated									6	0.01
Winona Corrugated										
Unknown Brown/Gray ware									1	0.00
Hopi Yellowwares										
Jeddito Plain										
Jeddito Corrugated										
Final Site Count	470		156		138		251		885	

TABLE 8.1. (continued)

WPS Number / MNA Number	WS 1096		WS 1107 2767		WS 1109 2769		WS 1111		WS 1132	
	No. of Sherds	Percent	No. of Sherds	Percent	No. of Sherds	Percent	No. of Sherds	Percent	No. of Sherds	Percent
Painted Pottery	166	0.52	109	0.29	88	0.26	282	0.49	188	0.57
Tusayan Whiteware	108	0.34	68	0.18	39	0.11	188	0.31	95	0.32
Kana B/w										
Black Mesa B/w										
Shato B/w			1	0.00						
Dogoszhi B/w			3	0.01	1	0.00	3	0.01		
Sosi B/w			6	0.02						
Flagstaff B/w	35	0.11	12	0.03	10	0.03	21	0.04	5	0.02
Wupatki B/w	5	0.02								
Tusayan B/w							36	0.06	14	0.05
Tusayan/Wupatki B/w										
Kayenta B/w										
Polacca B/w										
Kia'Ko B/w										
Betatakin B/w										
Unidentified	68	0.21	46	0.12	28	0.08	128	0.21	76	0.25
Little Colorado Whiteware	55	0.17	27	0.07	34	0.10	86	0.14	56	0.19
Holbrook B/w			4	0.01	1	0.00	2	0.00		
Padre B/w	6	0.02					4	0.01	2	0.01
Chevelon B/w							3	0.01		
Walnut B/w	16	0.05	2	0.01	11	0.03	12	0.02	11	0.04
Leupp B/w										
Unidentified	33	0.10	21	0.06	22	0.06	65	0.11	43	0.14
Tsegi Orangeware	3	0.01	12	0.03	15	0.04	8	0.01	19	0.06
Medicine B/r										
Tusayan B/r					1	0.00				
Cameron Polychrome					1	0.00				
Citadel Polychrome										
Tusayan Polychrome					1	0.00				
Citadel/Tusayan A Poly.	1	0.00			2	0.01				
Tsegi B/o										
Tsegie B/o										
Tsegie Polychrome										
Unidentified	2	0.01	12	0.03	10	0.03	8	0.01	19	0.06
Other Trade Types										
Tuzigoot White/red										
Cibola Whiteware			2	0.01						
St. John's Polychrome										
Unknown wares										
Plainware	154	0.48	271	0.71	253	0.74	316	0.53	130	0.43
Tusayan Grayware	120	0.38	192	0.51	142	0.42	275	0.46	118	0.39
O'Leary Tooled										
Honani Tooled										
Medicine Gray										
Tusayan Corrugated	1	0.00	32	0.08	25	0.07	12	0.02	4	0.01
Moenkopi Corrugated	55	0.17	92	0.24	63	0.18	85	0.14	48	0.16
Deadman's Corrugated										
Keam's Corrugated										
Little Colorado Corrugated										
Unidentified	64	0.20	68	0.18	54	0.16	178	0.30	66	0.22
Alameda Brownware	17	0.05	61	0.16	105	0.31	25	0.04	11	0.04
Rio de Flag Brown										
Win/Ang/Youngs Brown			30	0.08	59	0.17	2	0.00	5	0.02
Sunset Red/brown	17	0.05	4	0.01			6	0.01		
Sunset Plain			27	0.07	46	0.13	17	0.03	6	0.02
Turkey Hill Red										
Verde Brown										
Winona Red										
Unidentified										
San Francisco Mt. Grayware			17	0.04	4	0.01	1	0.00		
Deadmans Gray			16	0.04	3	0.01	1	0.00		
Deadmans Fugitive Red					1	0.00				
Deadmans B/g			1	0.00						
Prescott Grayware	14	0.04	1	0.00	1	0.00	15	0.03	1	0.00
Prescott Gray/orange	11	0.03	1	0.00			3	0.01		
Prescott B/g	3	0.01			1	0.00	12	0.02	1	0.00
Other Plainware										
Elden Corrugated	1	0.00								
Winona Corrugated										
Unknown Brown/Gray ware	2	0.00			1	0.00				
Hopi Yellowwares										
Jeddito Plain										
Jeddito Corrugated										
Final Site Count	320		380		341		598		300	

TABLE 8.1 (continued)

WPS Number / MNA Number	WS 1213		WS 1258		WS 1295		WS 1356		WS 1357 2756	
	No. of Sherds	Percent	No. of Sherds	Percent	No. of Sherds	Percent	No. of Sherds	Percent	No. of Sherds	Percent
Painted Pottery	74	0.30	317	0.46	69	0.27	150	0.27	69	0.31
Tusayan Whiteware	48	0.19	249	0.36	42	0.16	73	0.13	25	0.11
Kana B/w										
Black Mesa B/w							1	0.00	2	0.01
Shato B/w							1	0.00		
Dogoszhi B/w			5	0.01	1	0.00	1	0.00		
Sosi B/w	1	0.00					2	0.00	3	0.01
Flagstaff B/w	12	0.05	54	0.08	11	0.04	8	0.01	3	0.01
Wupatki B/w	1	0.00								
Tusayan B/w			12	0.02	4	0.02	3	0.01		
Tusayan/Wupatki B/w										
Kayenta B/w										
Polacca B/w										
Kia'Ko B/w										
Betatakin B/w										
Unidentified	34	0.14	178	0.26	26	0.10	57	0.10	17	0.08
Little Colorado Whiteware	15	0.06	68	0.10	16	0.06	61	0.11	36	0.16
Holbrook B/w					13	0.05			1	0.00
Padre B/w							2	0.00	1	0.00
Chevelon B/w										
Walnut B/w	2	0.01	25	0.04	3	0.01	8	0.01	2	0.01
Leupp B/w										
Unidentified	13	0.05	43	0.06			51	0.09	32	0.14
Tsegi Orangeware	11	0.04			11	0.04	16	0.03	8	0.04
Medicine B/r										
Tusayan B/r							4	0.01	2	0.01
Cameron Polychrome							1	0.00	1	0.00
Citadel Polychrome										
Tusayan Polychrome									2	0.01
Citadel/Tusayan A Poly.										
Tsegi B/o										
Tsegie B/o										
Tsegie Polychrome										
Unidentified	11	0.04			11	0.04	11	0.02	3	0.01
Other Trade Types										
Tuzigoot White/red										
Cibola Whiteware										
St. John's Polychrome										
Unknown wares										
Plainware	175	0.70	368	0.54	189	0.73	401	0.73	152	0.69
Tusayan Grayware	84	0.34	261	0.38	144	0.56	309	0.56	98	0.44
O'Leary Tooled										
Honani Tooled										
Medicine Gray										
Tusayan Corrugated			18	0.03	21	0.08	30	0.05	23	0.10
Moenkopi Corrugated	42	0.17	98	0.14	57	0.22	170	0.31	36	0.16
Deadman's Corrugated										
Keam's Corrugated										
Little Colorado Corrugated							1	0.00		
Unidentified	42	0.17	145	0.21	66	0.26	108	0.20	39	0.18
Alameda Brownware	16	0.06	8	0.01	5	0.02	72	0.13	52	0.24
Rio de Flag Brown										
Win/Ang/Youngs Brown	14	0.06	2	0.00	2	0.01	19	0.03	30	0.14
Sunset Red/brown							53	0.10	21	0.10
Sunset Plain	2	0.01	6	0.01	3	0.01				
Turkey Hill Red									1	0.00
Verde Brown										
Winona Red										
Unidentified										
San Francisco Mt. Grayware	13	0.05	6	0.01			11	0.02	2	0.01
Deadmans Gray	10	0.04	5	0.01			9	0.02	2	0.01
Deadmans Fugitive Red			1	0.00			2	0.00		
Deadmans B/g	3	0.01								
Prescott Grayware	52	0.21	93	0.14	40	0.16	3	0.01		
Prescott Gray/orange	33	0.13	89	0.13	35	0.14	2	0.00		
Prescott B/g	19	0.08	4	0.01	5	0.02	1	0.00		
Other Plainware										
Elden Corrugated	7	0.03					4	0.01		
Winona Corrugated										
Unknown Brown/Gray ware	3	0.01					2	0.00		
Hopi Yellowwares										
Jeddito Plain										
Jeddito Corrugated										
Final Site Count	249		685		258		551		221	

TABLE 8.1. (continued)

WPS Number MNA Number	WS 1361 2756		WS 1378		WS 1395 407		WS 1400 404		WS 1432 1755	
	No. of Sherds	Percent	No. of Sherds	Percent	No. of Sherds	Percent	No. of Sherds	Percent	No. of Sherds	Percent
Painted Pottery	66	0.32	223	0.25	43	0.06	263	0.15	64	0.24
Tusayan Whiteware	26	0.13	100	0.11	31	0.04	117	0.07	33	0.12
Kana B/w										
Black Mesa B/w			5	0.01	1	0.00	1	0.00	2	0.01
Shato B/w										
Dogoszhi B/w			5	0.01					3	0.01
Sosi B/w	10	0.05	16	0.02					1	0.00
Flagstaff B/w	2	0.01	9	0.01	1	0.00	17	0.01	7	0.03
Wupatki B/w										
Tusayan B/w			1	0.00			8	0.00		
Tusayan/Wupatki B/w										
Kayenta B/w										
Polacca B/w										
Kia'Ko B/w										
Betatakin B/w										
Unidentified	14	0.07	63	0.07	29	0.04	91	0.05	20	0.07
Little Colorado Whiteware	32	0.15	93	0.10	12	0.02	109	0.06	24	0.09
Holbrook B/w	3	0.01	12	0.01					5	0.02
Padre B/w							2	0.00		
Chevelon B/w										
Walnut B/w	3	0.01	14	0.02			19	0.01	6	0.02
Leupp B/w										
Unidentified	26	0.13	67	0.08	12	0.02	88	0.05	13	0.05
Tsegi Orangeware	8	0.04	30	0.03			27	0.02	7	0.03
Medicine B/r										
Tusayan B/r	3	0.01	9	0.01			1	0.00	1	0.00
Cameron Polychrome										
Citadel Polychrome										
Tusayan Polychrome							1	0.00		
Citadel/Tusayan A Poly.			6	0.01						
Tsegi B/o										
Tsegie B/o										
Tsegie Polychrome										
Unidentified	5	0.02	15	0.02			25	0.01	6	0.02
Other Trade Types										
Tuzigoot White/red										
Cibola Whiteware							1	0.00		
St. John's Polychrome							1	0.00		
Unknown wares							8	0.00		
Plainware	141	0.68	659	0.75	738	0.94	1,504	0.85	217	0.80
Tusayan Grayware	106	0.51	427	0.48	193	0.25	536	0.30	84	0.31
O'Leary Tooled	3	0.01								
Honani Tooled										
Medicine Gray										
Tusayan Corrugated	37	0.18	84	0.09	9	0.01	76	0.04	23	0.08
Moenkopi Corrugated	41	0.20	231	0.26	63	0.08	198	0.11	46	0.17
Deadman's Corrugated										
Keam's Corrugated										
Little Colorado Corrugated										
Unidentified	25	0.12	112	0.13	121	0.15	262	0.15	15	0.06
Alameda Brownware	31	0.15	200	0.22	517	0.66	951	0.54	126	0.46
Rio de Flag Brown										
Win/Ang/Youngs Brown	17	0.08	136	0.15	253	0.32	208	0.12	39	0.14
Sunset Red/brown	14	0.07	63	0.07	253	0.32	707	0.40	84	0.31
Sunset Plain										
Turkey Hill Red			1	0.00	11	0.01	36	0.02	3	0.01
Verde Brown										
Winona Red										
Unidentified										
San Francisco Mt. Grayware	4	0.02	32	0.04	1	0.00	4	0.00		
Deadmans Gray	3	0.01	32	0.04						
Deadmans Fugitive Red	1	0.00			1	0.00	4	0.00		
Deadmans B/g										
Prescott Grayware					18	0.02	4	0.00	1	0.00
Prescott Gray/orange					18	0.02	4	0.00	1	0.00
Prescott B/g										
Other Plainware										
Elden Corrugated					6	0.01	2	0.00	3	0.01
Winona Corrugated					1	0.00			1	0.00
Unknown Brown/Gray ware					2	0.00	7	0.00	2	0.01
Hopi Yellowwares										
Jeddito Plain										
Jeddito Corrugated										
Final Site Count	207		882		781		1,767		281	

TABLE 8.1. (continued)

WPS Number MNA Number	WS 1467		WS 1556 656		WS 1630 367		WS 1635 360		WS 1654 pot drp	
	No. of Sherds	Percent	No. of Sherds	Percent	No. of Sherds	Percent	No. of Sherds	Percent	No. of Sherds	Percent
Painted Pottery	58	0.21	152	0.36	542	0.42	71	0.34	165	0.99
Tusayan Whiteware	39	0.12	74	0.18	295	0.23	38	0.18	158	0.95
Kana B/w					1	0.00				
Black Mesa B/w	5	0.02			1	0.00				
Shato B/w					4	0.00				
Dogoszhi B/w	2	0.01	6	0.01	6	0.00	1	0.00	19	0.11
Sosi B/w	12	0.04	2	0.00	9	0.01	3	0.01	10	0.06
Flagstaff B/w	3	0.01	10	0.02	137	0.11	13	0.06	51	0.31
Wupatki B/w			9	0.02	6	0.00				
Tusayan B/w	1	0.00	3	0.01						
Tusayan/Wupatki B/w										
Kayenta B/w					1	0.00				
Polacca B/w										
Kia'Ko B/w					10	0.01				
Betatakin B/w										
Unidentified	16	0.05	44	0.11	120	0.09	21	0.10	78	0.47
Little Colorado Whiteware	15	0.05	70	0.17	143	0.11	16	0.08	7	0.04
Holbrook B/w	2	0.01	10	0.02	5	0.00				
Padre B/w	4	0.01	12	0.03	8	0.01				
Chevelon B/w										
Walnut B/w	2	0.01	22	0.05	62	0.05	4	0.02		
Leupp B/w			10	0.02	4	0.00	2	0.01		
Unidentified	7	0.02	16	0.04	64	0.05	10	0.05	7	0.04
Tsegi Orangeware	4	0.01	8	0.02	102	0.08	17	0.08		
Medicine B/r										
Tusayan B/r	3	0.01	4	0.01	24	0.02	2	0.01		
Cameron Polychrome										
Citadel Polychrome					10	0.01	1	0.00		
Tusayan Polychrome					13	0.01				
Citadel/Tusayan A Poly.										
Tsegi B/o										
Tsegie B/o										
Tsegie Polychrome										
Unidentified	1	0.00	4	0.01	55	0.04	14	0.07		
Other Trade Types										
Tuzigoot White/red										
Cibola Whiteware										
St. John's Polychrome										
Unknown wares					2	0.00				
Plainware	261	0.82	267	0.64	740	0.57	139	0.66	1	0.01
Tusayan Grayware	241	0.76	241	0.58	661	0.52	105	0.50	1	0.01
O'Leary Tooled					1	0.00				
Honani Tooled										
Medicine Gray										
Tusayan Corrugated	58	0.18	59	0.14	304	0.24	47	0.22		
Moenkopi Corrugated	103	0.32	79	0.19	185	0.14	29	0.14	1	0.01
Deadman's Corrugated	23	0.07	38	0.09	20	0.02	16	0.08		
Keam's Corrugated					5	0.00				
Little Colorado Corrugated										
Unidentified	57	0.18	65	0.16	146	0.11	13	0.06		
Alameda Brownware	14	0.04	5	0.01	33	0.03	16	0.08		
Rio de Flag Brown										
Win/Ang/Youngs Brown	3	0.01			4	0.00	8	0.04		
Sunset Red/brown	9	0.03	4	0.01	27	0.02	6	0.03		
Sunset Plain										
Turkey Hill Red	2	0.01			2	0.00	2	0.01		
Verde Brown										
Winona Red										
Unidentified			1	0.00						
San Francisco Mt. Grayware	4	0.01	5	0.01	29	0.02				
Deadmans Gray	4	0.01	5	0.01	24	0.02				
Deadmans Fugitive Red					5	0.00				
Deadmans B/g										
Prescott Grayware	2	0.01	16	0.04	17	0.01	18	0.09		
Prescott Gray/orange	2	0.01	16	0.04	14	0.01	18	0.09		
Prescott B/g					3	0.00				
Other Plainware										
Elden Corrugated										
Winona Corrugated										
Unknown Brown/Gray ware										
Hopi Yellowwares										
Jeddito Plain										
Jeddito Corrugated										
Final Site Count	319		419		1,282		210		166	

TABLE 8.1. (continued)

WPS Number / MNA Number	WS 1664 624		WS 1801 795		WS 1853		WS 1864		WS 1980	
	No. of Sherds	Percent	No. of Sherds	Percent	No. of Sherds	Percent	No. of Sherds	Percent	No. of Sherds	Percent
Painted Pottery	330	0.56	55	0.24	71	0.39	181	0.37	160	0.60
Tusayan Whiteware	149	0.25	34	0.15	28	0.15	51	0.10	60	0.22
Kana B/w			1	0.00						
Black Mesa B/w	6	0.01					1	0.00		
Shato B/w										
Dogoszhi B/w	26	0.04	5	0.02	6	0.03			4	0.01
Sosi B/w	10	0.02	3	0.01	4	0.02	3	0.01		
Flagstaff B/w	39	0.07	7	0.03	10	0.06	26	0.05	15	0.06
Wupatki B/w							2	0.00		
Tusayan B/w										
Tusayan/Wupatki B/w	5	0.01	2	0.01			2	0.00	16	0.06
Kayenta B/w										
Polacca B/w	1	0.00								
Kia'Ko B/w										
Betatakin B/w					1	0.01				
Unidentified	62	0.11	16	0.07	7	0.04	17	0.03	25	0.09
Little Colorado Whiteware	159	0.27	14	0.06	27	0.15	125	0.25	77	0.29
Holbrook B/w	3	0.01			4	0.02	3	0.01		
Padre B/w	27	0.05	7	0.03	1	0.01	27	0.05	5	0.02
Chevelon B/w										
Walnut B/w	45	0.08	3	0.01	11	0.06	55	0.11	39	0.15
Leupp B/w			1	0.00			2	0.00		
Unidentified	84	0.14	3	0.01	11	0.06	38	0.08	33	0.12
Tsegi Orangeware	22	0.04	7	0.03	16	0.09	5	0.01	23	0.09
Medicine B/r					2	0.01			1	0.00
Tusayan B/r	3	0.01	2	0.01	4	0.02	1	0.00		
Cameron Polychrome										
Citadel Polychrome	6	0.01	1	0.00	3	0.02	1	0.00		
Tusayan Polychrome	2	0.00	1	0.00			1	0.00		
Citadel/Tusayan A Poly.										
Tsegi B/o										
Tsegie B/o							1	0.00		
Tsegie Polychrome									1	0.00
Unidentified	11	0.02	3	0.01	7	0.04	1	0.00	21	0.08
Other Trade Types										
Tuzigoot White/red										
Cibola Whiteware										
St. John's Polychrome										
Unknown wares										
Plainware	255	0.44	171	0.76	110	0.61	312	0.63	108	0.40
Tusayan Grayware	203	0.35	142	0.63	82	0.45	196	0.40	82	0.31
O'Leary Tooled										
Honani Tooled					4	0.02				
Medicine Gray										
Tusayan Corrugated	51	0.09	26	0.12	21	0.12	24	0.05	12	0.04
Moenkopi Corrugated	80	0.14	76	0.34	31	0.17	146	0.30	46	0.17
Deadman's Corrugated	13	0.02			5	0.03				
Keam's Corrugated			3	0.01						
Little Colorado Corrugated										
Unidentified	59	0.10	37	0.16	21	0.12	26	0.05	24	0.09
Alameda Brownware	23	0.04	24	0.11	26	0.14	116	0.24	23	0.09
Rio de Flag Brown										
Win/Ang/Youngs Brown	3	0.01	3	0.01	9	0.05	51	0.10		
Sunset Red/brown	9	0.02	21	0.09	17	0.09	64	0.13	21	0.08
Sunset Plain										
Turkey Hill Red	5	0.01					1	0.00	2	0.01
Verde Brown										
Winona Red										
Unidentified	6	0.01								
San Francisco Mt. Grayware	5	0.01			2	0.01			1	0.00
Deadmans Gray	3	0.01							1	0.00
Deadmans Fugitive Red	1	0.00			2	0.01				
Deadmans B/g	1	0.00								
Prescott Grayware	23	0.04	5	0.02					2	0.01
Prescott Gray/orange	22	0.04	5	0.02					2	0.01
Prescott B/g	1	0.00								
Other Plainware										
Elden Corrugated										
Winona Corrugated										
Unknown Brown/Gray ware	1	0.00								
Hopi Yellowwares										
Jeddito Plain										
Jeddito Corrugated										
Final Site Count	585		226		181		493		268	

TABLE 8.1. (continued)

WPS Number MNA Number	WS 1992 3 pots		WS 1992 pot drp		WS 1998		WS 2001		WS 2002	
	No. of Sherds	Percent	No. of Sherds	Percent	No. of Sherds	Percent	No. of Sherds	Percent	No. of Sherds	Percent
Painted Pottery	158	1.00			58	0.23	83	0.44	59	0.31
Tusayan Whiteware	158	1.00			28	0.11	49	0.26	23	0.12
Kana B/w										
Black Mesa B/w					1	0.00			1	0.00
Shato B/w										
Dogoszhi B/w					4	0.02	4	0.02	3	0.02
Sosi B/w	60	0.38			5	0.02	2	0.01	3	0.02
Flagstaff B/w	33	0.21			14	0.06	12	0.06	7	0.04
Wupatki B/w										
Tusayan B/w										
Tusayan/Wupatki B/w					1	0.00	7	0.04	4	0.02
Kayenta B/w										
Polacca B/w										
Kia'Ko B/w										
Betatakin B/w										
Unidentified	65	0.41			3	0.01	24	0.13	5	0.03
Little Colorado Whiteware					24	0.10	30	0.16	34	0.18
Holbrook B/w										
Padre B/w					4	0.02	3	0.02	3	0.02
Chevelon B/w										
Walnut B/w					7	0.03	12	0.06	20	0.10
Leupp B/w							4	0.02	3	0.02
Unidentified					13	0.05	11	0.06	8	0.04
Tsegi Orangeware					6	0.02	2	0.01	2	0.01
Medicine B/r										
Tusayan B/r					2	0.01				
Cameron Polychrome										
Citadel Polychrome										
Tusayan Polychrome										
Citadel/Tusayan A Poly.										
Tsegi B/o										
Tsegie B/o										
Tsegie Polychrome										
Unidentified					4	0.02	2	0.01	2	0.01
Other Trade Types										
Tuzigoot White/red							2	0.01		
Cibola Whiteware										
St. John's Polychrome										
Unknown wares										
Plainware			117	1.00	192	0.77	104	0.55	134	0.69
Tusayan Grayware					110	0.44	80	0.43	101	0.52
O'Leary Tooled										
Honani Tooled										
Medicine Gray										
Tusayan Corrugated					5	0.02	10	0.05	7	0.04
Moenkopi Corrugated					101	0.40	61	0.33	85	0.44
Deadman's Corrugated							1	0.01	1	0.01
Keam's Corrugated										
Little Colorado Corrugated										
Unidentified					4	0.02	8	0.04	8	0.04
Alameda Brownware			117	1.00	76	0.30	19	0.10	12	0.06
Rio de Flag Brown										
Win/Ang/Youngs Brown					44	0.18	4	0.02	5	0.03
Sunset Red/brown			117	1.00	32	0.13	15	0.08	7	0.04
Sunset Plain										
Turkey Hill Red										
Verde Brown										
Winona Red										
Unidentified										
San Francisco Mt. Grayware					3	0.01				
Deadmans Gray										
Deadmans Fugitive Red					3	0.01				
Deadmans B/g										
Prescott Grayware					3	0.01	5	0.03	21	0.11
Prescott Gray/orange					3	0.01	4	0.02	15	0.08
Prescott B/g							1	0.01	6	0.03
Other Plainware										
Elden Corrugated										
Winona Corrugated										
Unknown Brown/Gray ware										
Hopi Yellowwares										
Jeddito Plain										
Jeddito Corrugated										
Final Site Count	158		117		250		187		193	

TABLE 8.1. (concluded)

WPS Number / MNA Number	WS 2285 pot drp		WS 2294		Surveyed Sites	
	No. of Sherds	Percent	No. of Sherds	Percent	No. of Sherds	Percent
Painted Pottery			10	0.10	7,409	36.13
Tusayan Whiteware					3,897	19.01
Kana B/w					2	0.01
Black Mesa B/w					43	0.21
Shato B/w					9	0.04
Dogoszhi B/w					182	0.89
Sosi B/w					234	1.14
Flagstaff B/w					906	4.42
Wupatki B/w					53	0.26
Tusayan B/w					218	1.06
Tusayan/Wupatki B/w					46	0.22
Kayenta B/w					1	0.01
Polacca B/w					2	0.01
Kia'Ko B/w					15	0.07
Betatakin B/w					1	0.01
Unidentified					2,185	10.66
Little Colorado Whiteware			10	0.10	2,785	13.58
Holbrook B/w			4	0.04	162	0.79
Padre B/w			2	0.02	173	0.84
Chevelon B/w					8	0.04
Walnut B/w					855	4.17
Leupp B/w					31	0.15
Unidentified			4	0.04	1,556	7.59
Tsegi Orangeware					709	3.46
Medicine B/r					5	0.02
Tusayan B/r					119	0.58
Cameron Polychrome					3	0.02
Citadel Polychrome					35	0.17
Tusayan Polychrome					25	0.12
Citadel/Tusayan A Poly.					12	0.06
Tsegi B/o					1	0.01
Tsegie B/o					1	0.01
Tsegie Polychrome					1	0.01
Unidentified					507	2.47
Other Trade Types						
Tuzigoot White/red					18	0.89
Cibola Whiteware					3	0.09
St. John's Polychrome					4	0.02
Unknown wares					1	0.01
Plainware	107	1.00	139	0.93	13,097	63.87
Tusayan Grayware			13	0.09	8,256	40.26
O'Leary Tooled					4	0.02
Honani Tooled					6	0.03
Medicine Gray					0	0.00
Tusayan Corrugated					1,720	8.39
Moenkopi Corrugated			11	0.07	3,869	18.87
Deadman's Corrugated					127	0.62
Keam's Corrugated					8	0.04
Little Colorado Corrugated			2	0.01	9	0.04
Unidentified					2,513	12.26
Alameda Brownware	107	1.00	117	0.79	3,510	17.12
Rio de Flag Brown					0	0.00
Win/Ang/Youngs Brown			21	0.14	1,233	6.01
Sunset Red/brown	107	1.00	96	0.64	2,024	9.87
Sunset Plain					107	0.52
Turkey Hill Red					77	0.38
Verde Brown					46	0.22
Winona Red					5	0.02
Unidentified					18	0.09
S. F. Mt. Grayware						
Deadmans Gray					530	2.58
Deadmans Fugitive Red					358	1.77
Deadmans B/g					153	0.72
Unidentified					19	0.10
Prescott Grayware					462	2.25
Prescott Gray/orange					372	1.81
Prescott B/g					90	0.44
Other Plainware					40	0.20
Elden Corrugated			9	0.06	38	0.19
Winona Corrugated					2	0.01
Unknown Brown/Gray ware					30	0.15
Hopi Yellowwares					269	1.31
Jeddito Plain					269	1.31
Jeddito Corrugated						
Final Site Count	107		149		20,505	100.00

Table 8.2. Ceramics from excavated sites.

Site Name MNA No.	Wukoki 203	Nalakihu 358	Citadel 355	Wupatki 405	Big Hawk 618	Big Hawk 680	Big Hawk 681	Big Hawk 682	Crack-in-Rock 537	Old Heizer 1754C	B.A. Heizer 1754E	Juniper Terrace 1814	Totals	Percent
Painted Pottery	109	932	168	7,241	503	1,018	535	413	75	805	68	2,368	14,235	25.13
Tusayan Whiteware	38	448	94	5,619	286	614	312	296	46	650	50	1,435	9,888	17.45
Kana-a B/W													0	0.00
Black Mesa B/W				21	35	42	8	8	1	22	7	138	282	0.50
Shato B/W				22		1		1				16	40	0.07
Dogoszhi B/W	1	155	10	169	56	113	19	55		27		196	801	1.41
Sosi B/W	19		29	280	37	31	12	15	1	361	20	51	856	1.51
Flagstaff B/W	10	239	44	3,266		222	110	100	37		5	826	4,859	8.57
Wupatki B/W	1	54		994		3	8					21	1,081	1.91
Tusayan B/W				2									2	0.003
Tusayan/Wupatki B/W													0	0.00
Kayenta B/W													0	0.00
Polacca B/W													0	0.00
Kia'ko B/W													0	0.00
Betatakin B/W													0	0.00
Unidentified	7		11	865	158	202	155	117	7	240	18	187	1,967	3.47
Little Colorado Whiteware	43	349	23	675	1	43	57	18	17	0	0	317	1,543	2.72
Holbrook B/W	3		1	5	1		2					12	24	0.04
Padre B/W		40											40	0.07
Chevelon B/W				7									7	0.01
Walnut B/W	40	309	22	611		43	46	18	17			283	1,389	2.45
Leupp B/W													0	0.00
Unidentified				52			9					22	83	0.15
Tsegi Orangeware	28	135	51	855	216	361	166	99	12	127	18	615	2,683	4.74
Medicine B/R	1			5	12	18	5	6			2	5	54	0.10
Tusayan B/R	8	109	43	399	175	179	96	48	5	127	6	465	1,660	2.93
Cameron Polychrome													0	0.00
Citadel Polychrome	10	25	8	385	12	44	32	19	4			119	658	1.16
Tusayan Polychrome	1	1		39								25	66	0.17
Cit/Tus A Poly.													0	0.00
Tsegi B/O												1	1	0.002
Tsegi R/O													0	0.00
Tsegi Polychrome				15									15	0.03
Kiet Siel Poly.				12									12	0.02
Unidentified	8				17	120	33	26	3		10		217	0.38
Other Trade Types				92						28		1	121	0.21
Tuzigoot White/Red													0	0.00
Cibola Whiteware													0	0.00
St. Johns Polychrome				14									14	0.03
Showlow B/R				78								1	79	0.14
Unknown wares										28			28	0.05
Plainware	90	1,645	126	22,619	3,514	2,704	966	1,164	79	1,684	118	7,712	42,421	74.88
Tusayan Grayware	71	593	89	5,783	487	1,278	479	877	76	944	108	3,799	14,584	25.74
O'Leary Tooled													0	0.00
Honani Tooled													0	0.00
Medicine Gray				74								1	75	0.13
Tusayan Corrugated	24	8	35	2,260	423	1,018	408	615	29		68	1,236	6,124	10.81
Moenkopi Corrugated	27	585	48	3,378	64	260	71	262	47		27	2,561	7,330	12.94
Deadmans Corrugated													0	0.00
Keams Corrugated													0	0.00
Little Colorado Corr.				71									71	0.13
Unidentified	20		6							944	13	1	984	1.74
Alameda Brownware	19	1,005	20	15,790	920	114	66	28	2	521	5	1,218	19,708	34.79
Rio de Flag												21	21	0.04
Win/Ang/Youngs Brown	4		12	2,942	909	63	35	17				979	4,961	8.76
Sunset Red/Brown	15	11	8	12,287	10	31	25	9	2			194	12,592	22.23
Sunset Plain													0	0.00
Turkey Hill Red		994		561	1	17	6	2				24	1,605	2.83
Verde Brown													0	0.00
Winona Red													0	0.00
Unidentified											5		5	0.01
Clear Creek Brown						3							3	0.01
Unidentified										521			521	0.92
San Francisco Mt. Grayware	0	0	12	355	2,097	1,290	403	215	0	219	0	2,678	7,269	12.83
Deadmans Gray			12	127	814	829	263	119				1,407	3,571	6.30
Deadmans Fugitive Red				226	1,280	414	130	90				1,232	3,372	5.95
Deadmans B/G				2	3	47	10	6				39	107	0.19
Unidentified										219			219	0.39
Prescott Grayware	0	0	5	230	10	22	18	44	1	0	0	16	346	0.61
Prescott Grey/Orange			5	230	10	15	17	41	1			16	335	0.59
Prescott B/G						7	1	3					11	0.02
Other Plainware	0	47	0	461	0	0	0	0	0	0	5	1	514	0.91
Elden Corrugated				187									187	0.33
Winona Corrugated				9									9	0.02
Winona Smudged				1									1	0.002
Flagstaff Red		47											47	0.08
Linden Corrugated				180									180	0.32
Tonto Red				4									4	0.01
McDonald Corrugated				1									1	0.002
Walnut Corrugated				8									8	0.01
Wingfield Plain											5	1	6	0.01
Little Colorado Currugated				71									71	0.13
Unknown Brown/Grey Ware	0	0	0	0	0	0	0	0	0	0		0	0	0.00
Hopi Yellowwares	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
Jeddito Plain													0	0.00
Jeddito Corrugated													0	0.00
FINAL SITE COUNT	199	2,577	294	29,860	4,017	3,722	1,501	1,577	154	2,489	186	10,080	56,656	100.00

Table 8.3. Excavated and surveyed sites compared.

	Surveyed Sites		Excavated Sites	
	Number	Percent	Number	Percent
Painted Pottery	7,409	36.13	14,235	25.13
Tusayan Whiteware	3,897	19.01	9.888	17.45
Kana-a B/W	2	0.01	0	0.00
Black Mesa B/W	43	0.21	282	0.50
Shato B/W	9	0.04	40	0.07
Dogoszhi B/W	182	0.89	801	1.41
Sosi B/W	234	1.14	856	1.51
Flagstaff B/W	906	4.42	4,859	8.57
Wupatki B/W	53	0.26	1,081	1.91
Tusayan B/W	218	1.06	2	0.003
Tusayan/Wupatki B/W	46	0.22	0	0.00
Kayenta B/W	1	0.01	0	0.00
Polacca B/W	2	0.01	0	0.00
Kia'ko B/W	15	0.07	0	0.00
Betatakin B/W	1	0.01	0	0.00
Unidentified	2,185	10.66	1,967	3.47
Little Colorado W.W.	2,785	13.58	1,543	2.72
Holbrook B/W	162	0.79	24	0.04
Padre B/W	173	0.84	40	0.07
Chevelon B/W	8	0.04	7	0.01
Walnut B/W	855	4.17	1,389	2.45
Leupp B/W	31	0.15	0	0.00
Unidentified	1,556	7.59	83	0.15
Tsegi Orangeware	709	3.46	2,683	4.74
Medicine B/R	5	0.02	54	0.10
Tusayan B/R	119	0.58	1,660	2.93
Cameron Polychrome	3	0.02	0	0.00
Citadel Polychrome	35	0.17	658	1.16
Tusayan Polychrome	25	0.12	66	0.17
Citadel/Tusayan A Poly.	12	0.06	0	0.00
Tsegi B/O	1	0.01	1	0.002
Tsegi R/O	1	0.01	0	0.00
Tsegi Polychrome	1	0.01	15	0.03
Kiet Siel Polychrome			12	0.02
Unidentified	507	2.47	217	0.38
Other Trade Types	18	0.89	121	0.21
Tuzigoot White/Red	3	0.09	0	0.00
Cibola Whiteware	4	0.02	0	0.00
St. Johns Polychrome	1	0.01	14	0.03
Showlow B/R			79	0.14
Unknown wares	10	0.05	28	0.05
Plainware	13,096	63.87	42,421	74.88
Tusayan Grayware	8,256	40.26	14,584	25.74
O'Leary Tooled	4	0.02	0	0.00
Honani Tooled	6	0.03	0	0.00
Medicine Gray	0	0.00	75	0.13
Tusayan Corrugated	1,720	8.39	6,124	10.81
Moenkopi Corrugated	3,869	18.87	7,330	12.94
Deadman's Corrugated	127	0.62	0	0.00
Keams Corrugated	8	0.04	0	0.00
L. Colo. Corrugated	9	0.04	71	0.13
Unidentified	2,513	12.26	984	1.74
Alameda Brownware	3,510	17.12	19,708	34.79
Rio de Flag Brown	0	0.00	21	0.04
Win/Ang/Youngs Brown	1,233	6.01	4,961	8.76
Sunset Red/Brown	2,024	9.87	12,592	22.23
Sunset Plain	107	0.52	0	0.00
Turkey Hill Red	77	0.38	1,605	2.83
Verde Brown	46	0.22	0	0.00
Winona Red	5	0.02	0	0.00
Unidentified	18	0.09	5	0.01
Clear Creek Brown			524	0.93
San Francisco Mt. Grayware	529	2.58	7,269	12.83
Deadmans Gray	362	1.77	3,571	6.30
Deadmans Fugitive Red	147	0.72	3,372	5.95
Deadmans B/G	20	0.10	107	0.19
Unidentified			219	0.39
Prescott Grayware	462	2.25	346	0.61
Prescott Gray/Orange	372	1.81	335	0.59
Prescott B/G	90	0.44	11	0.02
Other Plainware	40	0.20	514	0.91
Elden Corrugated	38	0.19	187	0.33
Winona Corrugated	2	0.01	8	0.02
Winona Smudged			1	0.002
Flagstaff Red			47	0.08
Linden Corrugated			180	0.32
Tonto Red			4	0.01
McDonald Corrugated			1	0.002
Walnut Corrugated			8	0.01
Wingfield Plain			6	0.01
Little Colorado Corrugated			71	0.13
Unknown Brown/Gray ware	30	0.15	0	0.00
Hopi Yellowwares	269	1.31	0	0.00
Jeddito Plain	269	1.31	0	0.00
Jeddito Corrugated			0	0.00
Final Count	20,505	100.00	56,656	100.00

The problem of area of origin and manufacture of the ceramic types, both decorated and plain, is still with us. Colton (e.g., 1941, 1946) discussed the origins of the clays and tempers found in Sinagua-area pottery and concluded that nearly all decorated pottery was imported from other areas. He concluded that even such types as Citadel Polychrome, more common in the Sinagua region than any other, were thus imports (Colton 1941:34). In short, the local or foreign manufacture of many Wupatki-area ceramics is still a matter of debate, and thus their dates are not securely known, either.

Different methods of classification are common. I, for example, see much more Little Colorado White and Gray ware in the collection than do some of my colleagues; and I see less of the exotic trade wares and rare corrugated wares than do some of my fellow ceramicists. More than this, however is involved: there are different competing theories of classification, for example, Jernigan (1986) and Douglass and Lindauer (1988). There are also different standards of inclusion and exclusion. Some measure line width, percent of temper types or precise temper sizes; others analyze design styles and motifs. Obviously, different types and/or different percentages of types will result.

Typology and Classification

Plain Ware (13,097, or 64%)

Plain wares are assumed to be index wares, typical of a particular cultural tradition (e.g., Colton 1946), and thus are used to specify the type of prehistoric people who lived at the site. Their time spans of manufacture and use are so long, however, that they are not useful for dating. Problems of classification also are many, since surface details are often very similar, and thus technological differences must often be stressed.

Tusayan Gray Ware (9,256. or 40%)

There are seven types identified in the survey collection, including two rare, early, tooled types (10 sherds, a trace), and three rare, later, corrugated varieties (Deadman's, Keams, and Little Colorado Corrugated), a total of 144 sherds, or a bit less than 1%. The most common two varieties include more than 27% of the total pottery of the survey (Tusayan Corrugated, 1,720 or 8%; and Moenkopi Corrugated, 3,869, or 19%). Colton (1946:48) believed that they were Kayenta Anasazi types native to the Four Corners area, and thus foreign in the Sinagua and Monument areas except in the extreme northeast of the Wupatki Basin. In general, Colton felt that the type was manufactured north of the San Francisco Mountains and east of the Kaibab Plateau. The types are coiled and scraped, with the coils usually showing on the outer surface (post-Pueblo II), and they are generally reduced in firing. The arrangement of coils, their depth and symmetry, or their smearing or obliteration (e.g., Monekopi Corrugated) are the criteria for classification; but the later types, at least, intergrade, leaving a trend but no sharp categories. Bowls and jars are often impossible to classify unless the shape of the pot or rim sherds are available.

Alameda Brown Ware (3,510. or 17%)

There are nine types of brown ware found in the survey collection, and all are assumed to have been made locally by the Sinagua in the San Francisco Mountain

region. They differ mostly in the type, size, and percentage of temper; colors may be brown, reddish, or tan, and they intergrade. Late types (Sunset Red and later) are often smudged and may be highly burnished inside. Tempers of the early types include various forms of tuff and sands, while later types (Sunset Red and later) often have ash temper instead. Elden Corrugated may fall into this category. In particular, the Angel, Youngs, and Winona Brown groups (counted as one unit in our classification) are particularly hard to subdivide, being separated only by size of temper or percentage ratio of temper types. All have tuff temper and all are dated to the same period, the assumption being that they may have been made in different parts of the same cultural region. In any case, these and all other Alameda Brown wares are paddle-and-anvil made and are constructed from basaltic clays (with high iron content), which are then oxidized to bring out the earth tones (for Elden Corrugated, see Colton 1941:34-45; Colton 1946:23-26; and Colton and Hargrave 1937:63-64).

In the larger sites of the Monument, Winona, Angel, and Youngs Brown are 6% of the total collection (1,233 sherds), but the most common type of the ware, Sunset Red/Brown includes 2,024 sherds, or 10% of the total survey pottery. All of the other five types (if we include Elden Corrugated) total about 291 sherds, less than 1.5%. In addition, the late variety, Turkey Hill Red, was found at 12 small sites, a total of 67 sherds, with one settlement having 36 sherds. Winona Red was found at 5 sites, with 10 sherds.

The ware is rare at most sites (two-thirds of the sites had under 20%, according to Downum and Sullivan, and only 9% of the sites have as much as 50%. They believe that only six sites had a clear Sinagua majority (I would state nine), and we all agree that they are mainly found around the south-central area and Wupatki Ruin--itself a site with much brown ware (see Table 2). The distribution suggests that Sinagua groups moved into these Monument areas from the south and established Wupatki Pueblo as their major site, perhaps intending it as their trade center.

San Francisco Mountain Gray Ware (530. or 2.5%)

Three types of gray ware are represented: Deadman's Gray, Deadman's Fugitive Red, and Deadman's Black-on-gray. The types are quite easily separated from other plain wares because of their slick, highly polished, pewter-like appearance, but the fugitive red may be confused with the plain gray because the red slip is so easily washed off or faded.

Deadman's Gray (358, or 2%) is by far the most common type at the larger sites, followed by Deadman's Fugitive Red (153, or 1%), and Deadman's Black-on-gray (19 sherds). No larger site had a majority of these types, and only 11 had strong minority representation. Four sites also had a mixture of Cohonina and Sinagua plain wares. In contrast to most other cases, however, the types are even more common at the small sites (663 sherds of both the plain gray and red at 60 sites, 8 having more than 20 sherds), thus suggesting that Cohonina culture sites, or influences, are more likely to be associated with small farmsteads or villages than with the larger pueblos. Downum and Sullivan believe that the ware was uncommon at Wupatki Monument, being found in less than 20% of the plain ware collections at more than 80% of the sites, and they believe that it was a majority of the plain ware in less than 10% of the small sites. The painted type is also more common at small sites (36 sherds found at 20 sites).

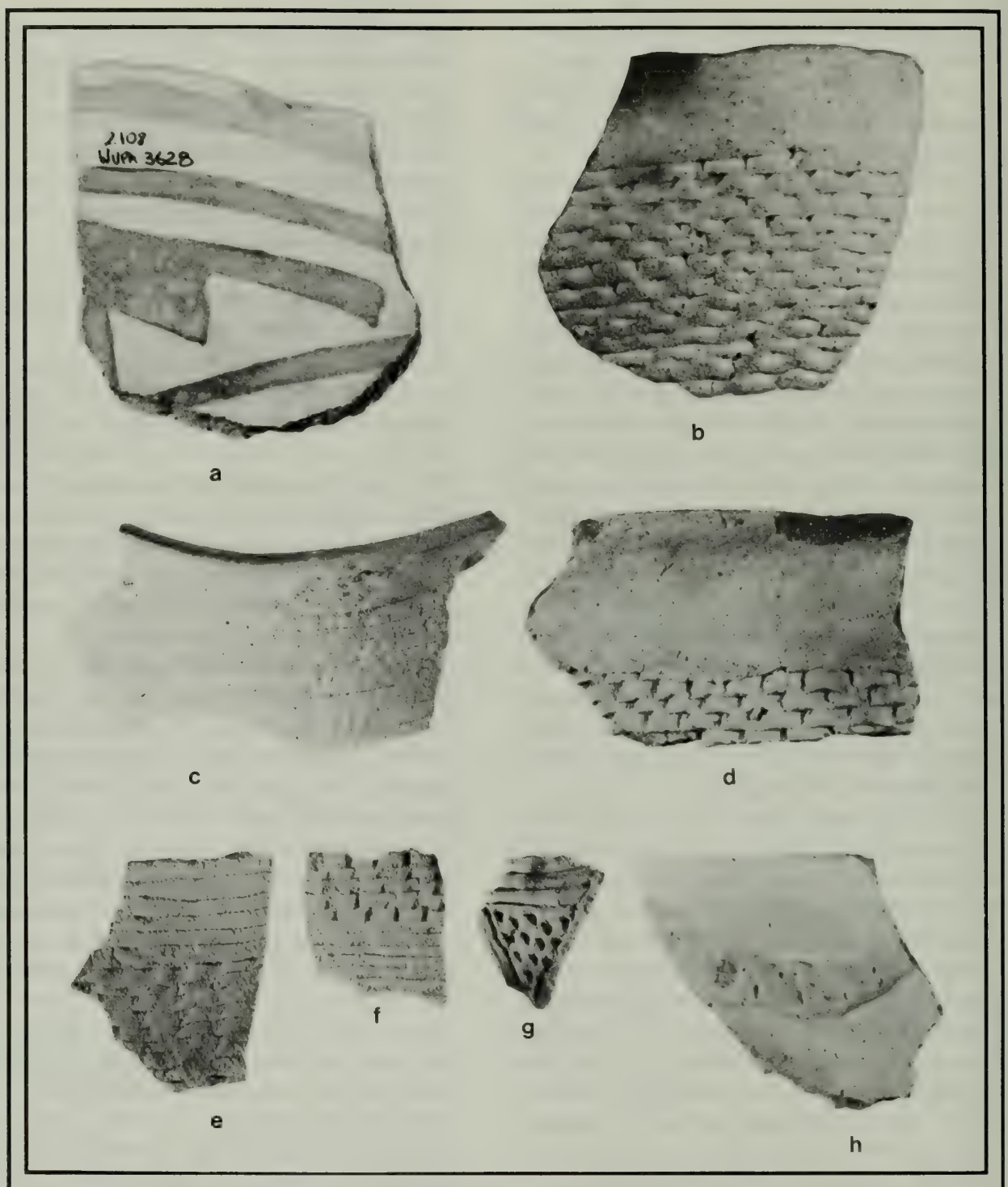


FIGURE 8.1. Tusayan Gray Ware. a and b-WUPA 3628, Shato B/W; c-WUPA 2463, Moenkopi Corrugated; d-WUPA 2106, e-WUPA 2436, and f-WUPA 2294, all Tusayan Corrugated; g-WUPA 3630, O'-Leary Tooled; and h-WUPA 2414, Tusayan Applique.

Colton believed that such Cohonina-tradition pottery was made from Kaibab limestone and clays (Colton 1941:47-48; Colton 1946:29). It was constructed with paddle and anvil, and the interiors were also scraped. The limestone-based clays were quartz tempered and fired in a reducing atmosphere to bring out the gray. All such sherds would be considered trade wares, or evidence of local immigration, and they are almost all found in the western part of the Monument. Among excavated settlements, the Big Hawk Valley sites all have high amounts and ratios of this ware, and they are the kind of western farming communities in which we might expect to see such ceramics.

Prescott Gray Wares (462. or 2%)

The ware is represented by two major types at large sites of the Monument: a plain gray or orange ware (372, or 2%) and a black-on-gray or orange, Prescott Black-on-gray, (90, or 0.5%). One sherd of Aquarius Tooled was found at a small site. Small sites, again, had a majority of the ware: 493 sherds of other types were found at 82 settlements, and thus, as with the case of Deadman's Grayware, Prescott Gray was equally, as common as, if not more common then, the total of other types at small villages. The plain variety was found in the amount of 441 sherds at 49 small villages, and 52 sherds of the painted variety appeared at 33 settlements. Sixteen small sites had 6-20 sherds, and a number had more, one with 89. No large site had a majority of such plain ware, and only nine had a strong minority representation. All were in the western Monument area. One site had a minority mix of Prescott and Sinagua types.

The ware is thought to represent the southern Prescott Valley tradition and is distinguished by a heavy micaceous temper in the clay. The orange and gray varieties seem to intergrade and are often lumped, as we have done. Presumable a trade ware, or evidence of immigration, the ware is found in many sites of the San Francisco Mountain area, although it is usually quite rare (Downum and Sullivan point out that less than 5% of the Wupatki Monument sites have more than 20% of such plain ware).

Minor Types (339. or 2%)

Finally, three minor plain ware types were identified at large sites: Elden Corrugated, which was discussed as a possible Alameda Brown ware with different corrugations and ash temper; Winona Corrugated, assumed to be a Mogollon Brown ware, and thus exotic to the San Francisco Mountains; and a Hopi ware, Jeddito Plain, presumably a later (post-occupation?) type left by a Hopi visitor (Colton 1941:30-31). Thirty "unknown" sherds are also included in this unit.

All of the named types are rare in the survey collection. Two Winona Corrugated sherds were found in our sample sites, and only two more at smaller sites. Thirty-eight Elden Corrugated sherds were found in larger sites, but although 107 were found at 19 small sites, no more than 7 were found at any one village, about the same average as at the larger settlements. The Jeddito Corrugated sherds (269) were found in a situation suggesting that they were part of the same pot, which had been broken or abandoned where found. Small villages had seven other Hopi plain ware sherds: three sites had four Jeddito Corrugated, and three other sites had three Jeddito Plain.

However, the small site collection had four other types: McDonald Corrugated, a Mogollon type with paint over the outside corrugations (4 sherds at 2 sites); Little Colorado Corrugated, presumably a Winslow-area type (see Colton 1944; 10

sherds at 7 sites); Grapevine Plain (1 sherd at 1 site); and Floyd Plain (2 sherds at 2 sites). The last two types are said to be part of the Anderson Mesa and Deadman's series, respectively, and thus trade wares from nearby areas. These types appear to be even more rare in our sample of excavated sites.

Decorated Pottery (7,409, or 36%)

Decorated wares comprise only about one-third of the pottery of sites with more than 100 sherds, but because of their utility in both dating and indicating trade or immigration, they are even more important than the plain wares. Colton believes most, if not all, decorated pottery was traded from the Kayenta or Winslow Anasazi areas, a conclusion that is still in question.

Tusayan White Wares (3,897. or 19%)

This ware, the largest category of painted pottery, includes 3,897 sherds in the larger sites and more than 800 in the smaller villages. The most common large-site ceramic category listed, however, is "unidentified body sherds" (2,185, or 11%). The most common identified type, Flagstaff Black-on-white (906, or 4%), represents the period of major occupation of the Monument. The next most common type, Sosi Black-on-white, is represented by only 234 sherds, about 1% of the total.

All of the Tusayan white wares were coiled, scraped, and tempered with quartz sand and "dark fragments" (sherds?). They have light cores, and a light, white, watery slip. Colton believes that the types were all made north of the Little Colorado River and were thus trade wares in most of the Sinagua territory.

Of the 12 types found at larger sites, the 3 early types and the 4 later types had less than 50 sherds, usually less than 20 (see Tables 1 and 3). Kana'a Black-on-white was represented by 2 sherds at the larger sites and 16 sherds at 12 smaller sites. Black Mesa Black-on-white totaled 43 at large sites and 56 at 35 smaller sites. On the other hand, Shato Black-on-white (9 at larger sites) was only found at 6 smaller sites, with a total of 6 sherds.

Dogoszhi and Sosi Black-on-white included over 400 sherds, or about 2% of the total pottery of the large sites. But except for Flagstaff Black-on-white, already discussed, the later types are rare in large sites--all together less than 2% (336 sherds in 6 types). For example, only 2 Kayenta Black-on-white sherds were identified in the large sites, and 1 in a small site; 15 Kia'Ko Black-on-white were found at large sites, and 18 at 5 small sites; 2 Polacca Black-on-white at large sites and 3 at 3 small sites. Tusayan/Wupatki Black-on-white, on the other hand, was by far the most common late type, comprising 317 sherds at larger sites and at least 474 sherds in more than 64 small sites. One Betatakin Black-on-white sherd was found in 1 of the small sites. It is interesting to note that while this is the most abundant painted ware, only 17 sites had a Tusayan White ware majority and could be called Kayenta Anasazi sites.

Little Colorado White Ware (2,785. or 14%)

This was only the second most common ware, but at least 46 sites, almost three times more than had a Tusayan majority, had a Little Colorado White ware majority, and

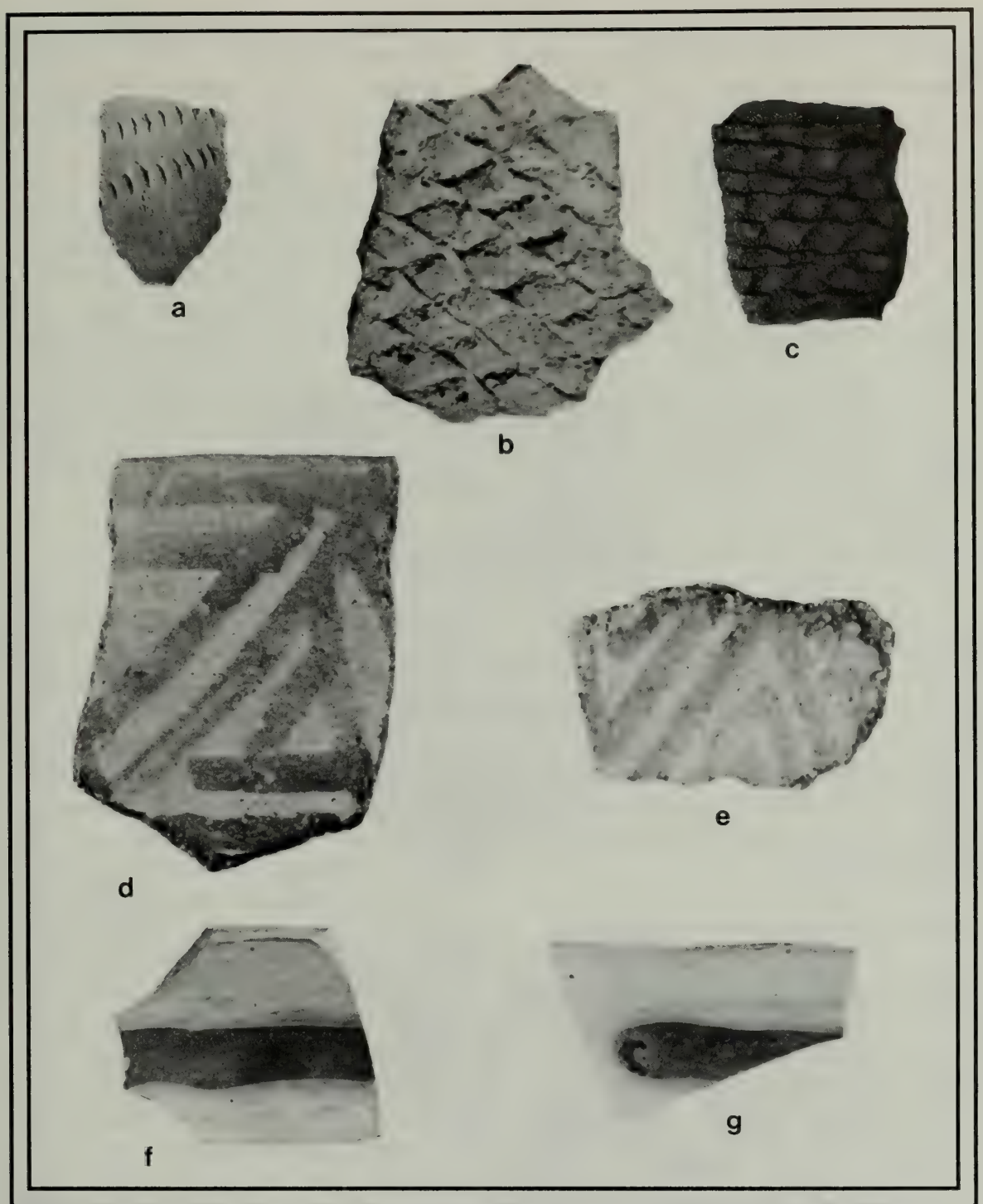


FIGURE 8.2. Other Wares.: a-WUPA 2468, Rio de Flag Tooled; b-WUPA 3670, Little Colorado Corrugated; c-WUPA 2297, Elden Corrugated; d-WUPA 2467 and e-WUPA 2448, Verde B/G; and f and g-WUPA 3572, Jeddito B/Y.

thus were classified as Winslow-tradition Anasazi sites. Again, nearly 60% of the ware includes general body sherds (1,556, or 8% of the total sherds of the survey). Early types such as Holbrook, Padre, and Chevelon Black-on-white are rare, totaling 343, or 1.7% of the total survey, while a late type, Leupp Black-on-white, totaled only 31 sherds. At least 220 sherds of early types were also found at more than 60 smaller sites, and 47 sherds of Leupp were found at 19 small sites. By far the most common variety is Walnut Black-on-white (855 sherds, or 4%), which represents the major period of occupation of the sites.

The ware is contrasted to Tusayan white ware by being thicker, with a softer paste, a dark gray clay-like core, white volcanic tuff temper, and a thick chalk-white slip on which black designs stand out. The clay is high in iron, firing gray, and thus it required a very thick white slip. The slip, however, tends to erode and fade away, removing the design and again revealing the core. Colton (1941:52-54) believed that the type was developed in the black sand area east of Flagstaff and was a diagnostic type of the Winslow Tradition.

Tseai Orange Ware (709. or 3.5%)

A coiled and scraped Anasazi-type pottery, it is oxidized to produce a light orange background color, often with a pink-gray core. It has conspicuous yellowish sherd and quartz sand temper. Designs are executed in red, white, and black paint. Colton believed that the types were made in both the Hopi and the Rainbow Plateau areas and comprised a trade ware throughout the Sinagua territory, even though some types, such as Citadel Polychrome, seem to have been most common in the Sinagua area and have local temper.

The largest category of sherds is again "unidentified" (507, or 2.5%); but Citadel and Tusayan Polychrome are the most common types and overlap and intergrade in some of their varieties (72 sherds, or 0.5%). Tsegi Black-on-orange, Tsegi Red-on-orange, and Tsegi Polychrome are very rare--1 sherd each in the larger sites sample, and 7 sherds at 5 sites in the small site group. Among the earlier types, only Tusayan Black-on-red is more common (119 sherds, or 0.5%). Cameron Polychrome and Medicine Black-on-red are found in quantities of 3 to 5 sherds each. Eleven sherds of Medicine Black-on-red were also found at 9 small sites.

Rare Types (18 sherds)

Four sherds of Cibola White ware were collected in large sites, and 4 more in 3 small sites; one sherd of St. John's Polychrome came from a large site, and one from a small site. These indicate some trade from the prehistoric Zuni region, or the White Mountains. Two Hopi-area Black-on-orange sherds were found in 1 small site. The 3 sherds of Tuzigoot White-on-red found in the survey of larger sites and the 5 sherds found at 3 smaller sites, along with the 3 Hohokam sherds in smaller sites, indicate some trade from the Verde Valley or even farther south. The 4 Winslow Black-on-white sherds from 2 smaller sites reaffirm the contacts with the Winslow branch.

Our problem is this: Either almost all the painted pottery is trade ware, or nearly all is local, with very little outside trade contact at all. The decision depends upon whether one accepts Colton's belief that the painted wares are all Hopi, Kayenta, or Winslow area products. In either case, all of the painted wares and a handful of track sherds and Anasazi, with the exception of the few sherds of Prescott and Deadman's

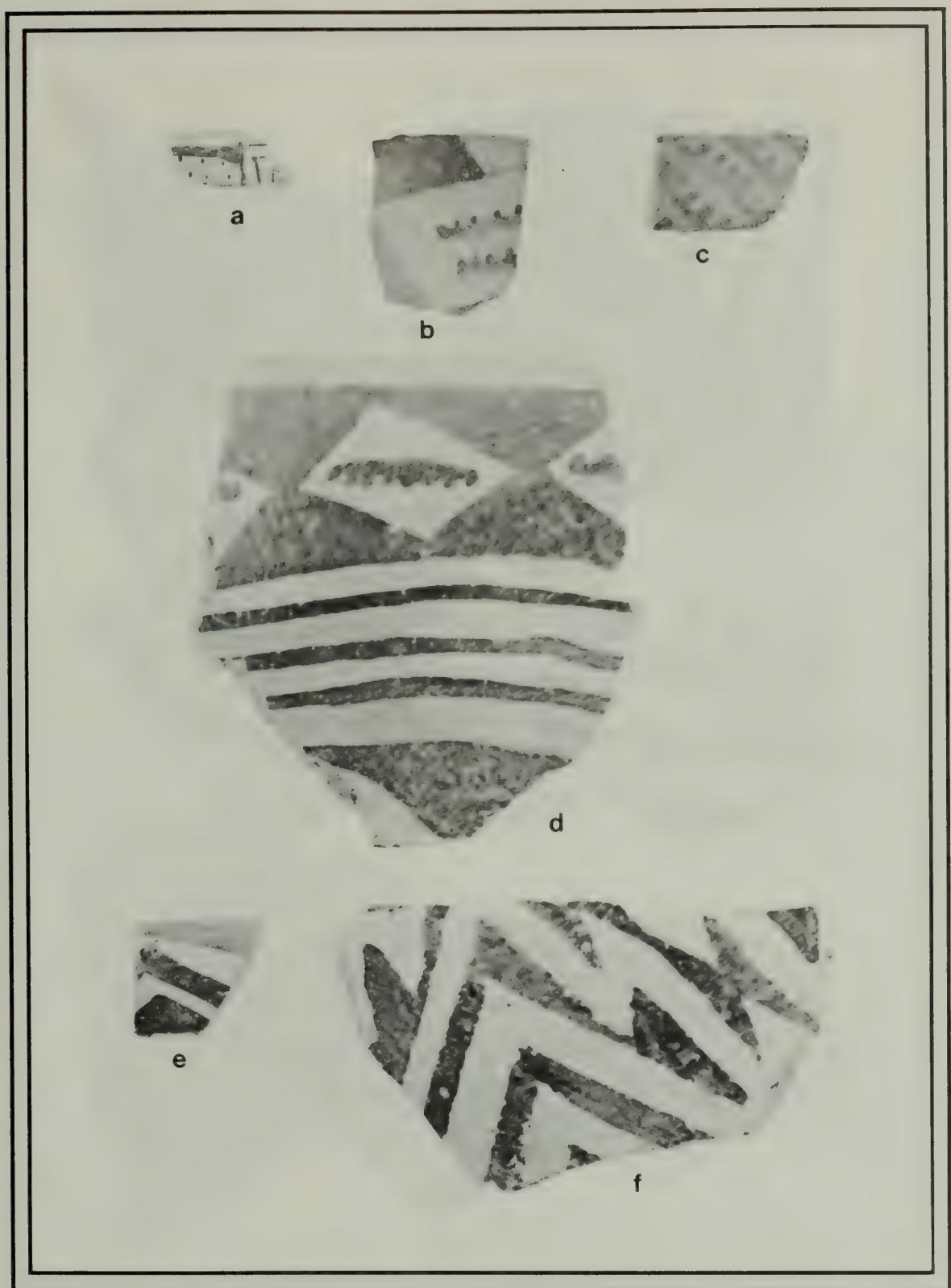


FIGURE 8.3. Tusayan White Ware: a-WUPA 2227, Kana-a B/W; b and c-WUPA 2452 and d-WUPA 3638, Black Mesa B/W; and e-WUPA 2241 and f-WUPA 2429, Sosi B/W.

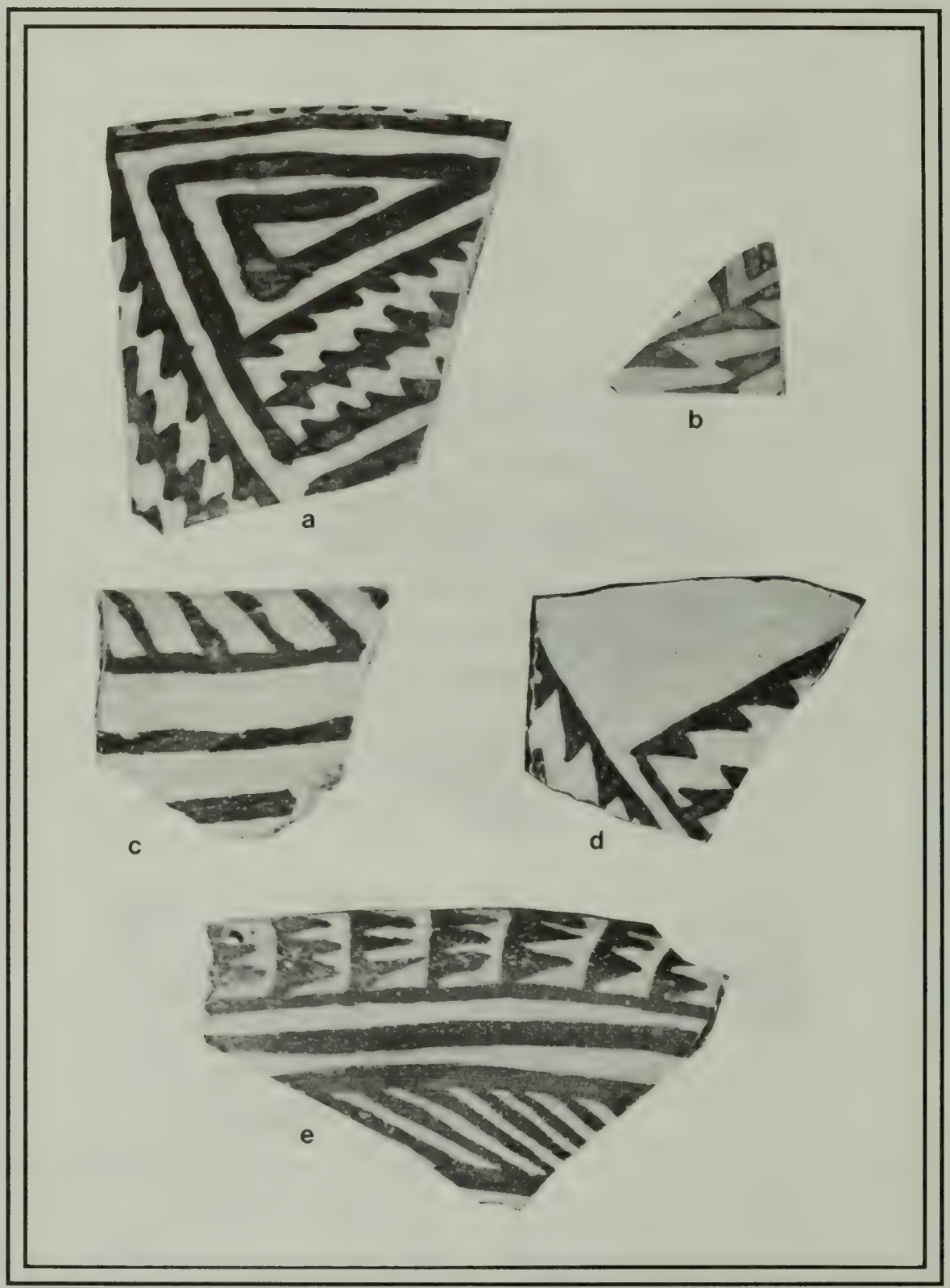


FIGURE 8.4. Tusayan White Ware: a-WUPA 2428, b-WUPA 2442, c-WUPA 5973, d-WUPA 5988, and e-WUPA 5987, all are Flagstaff B/W.

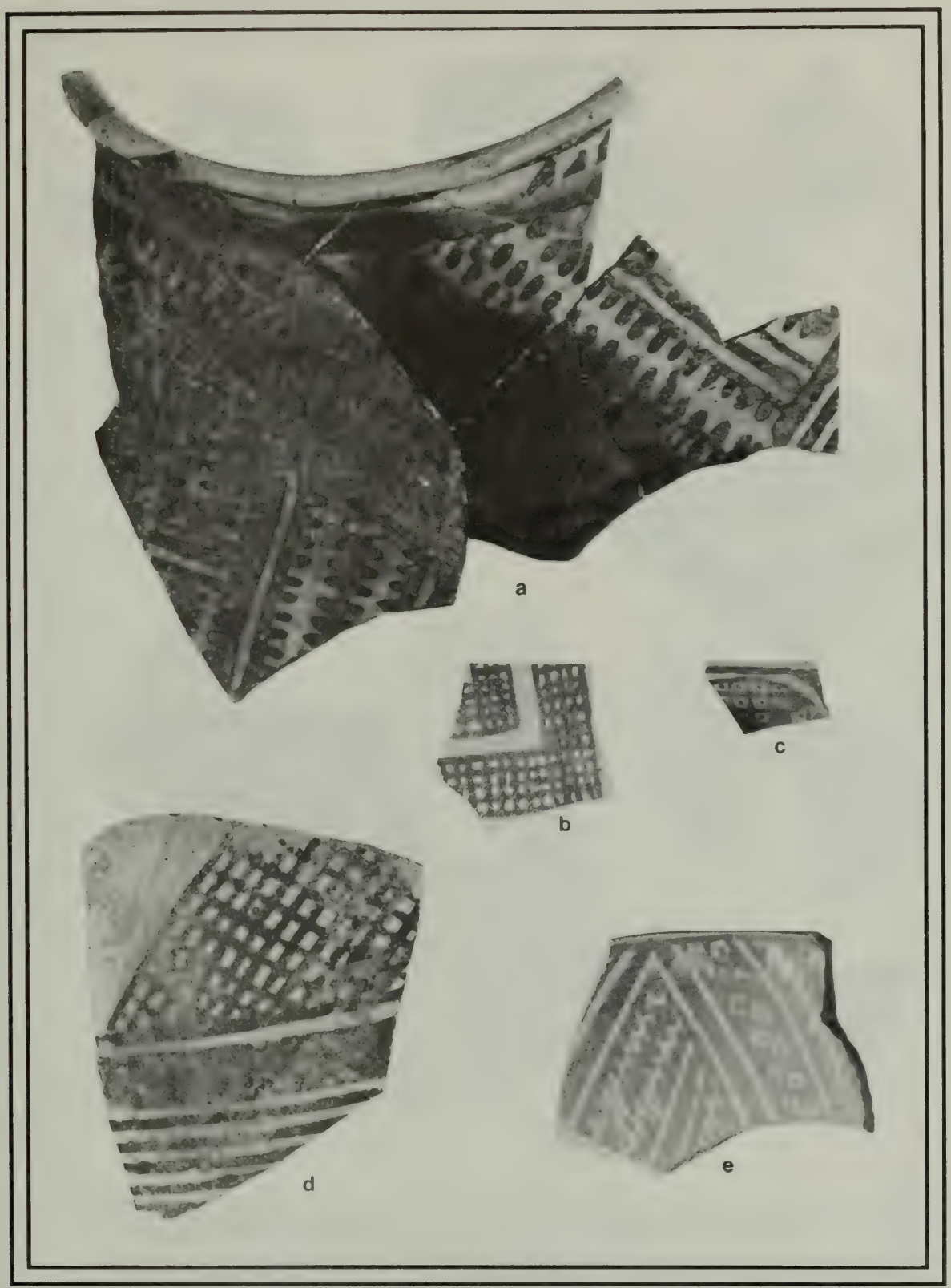


FIGURE 8.5. Tusayan White Ware:a-WUPA 3403, Wupatki B/W; b-WUPA 2454, c-WUPA 2458, d-WUPA 2464, and e-WUPA 2460, are Tusayan B/W.

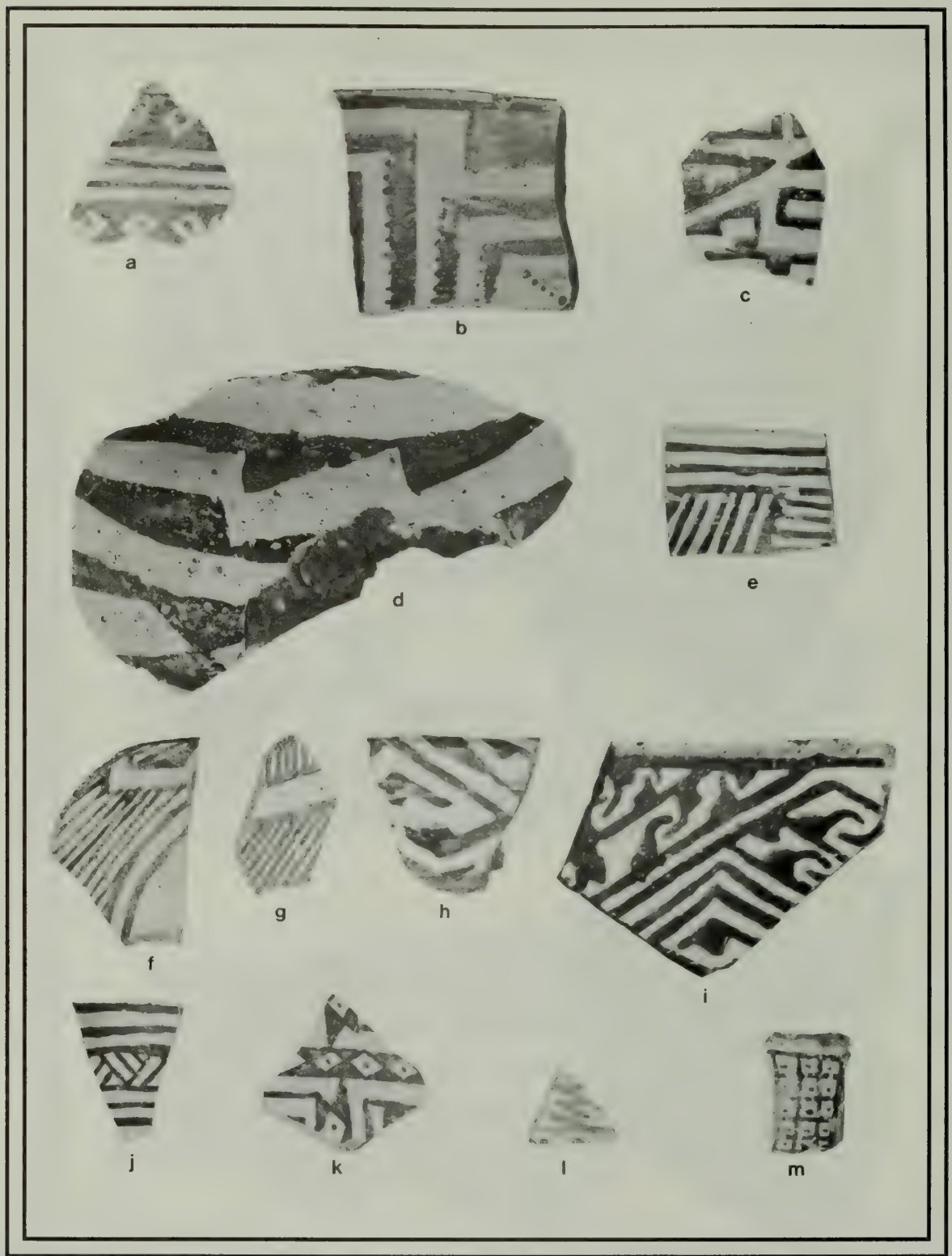


FIGURE 8.6. Little Colorado White Ware: a-WUPA 2465and b-WUPA 5984, Holbrook B/W, Variety A; c-WUPA 2446 and d-WUPA 3526, Holbrook B/W, Variety B; e-WUPA 2461 and f-WUPA 2457, Padre B/W; g-WUPA 2462 and h-WUPA 3681, Chevelon B/W; i-WUPA 2016, j and k-WUPA 2441, lWUPA 2443, ar3e Walnut B/W; and m-WUPA 2439, Leupp B/W.

FIGURE 8.7. Tsegi Orange Ware: a and b-WUPA 2222 and c-WPA 2440, Tusayan B/R; d-WUPA 2444 and e-WUPA 2437, Tsegi B/O; f-WUPA 2445, Medicine B/R; and g-WUPA 2431 and h-WUPA

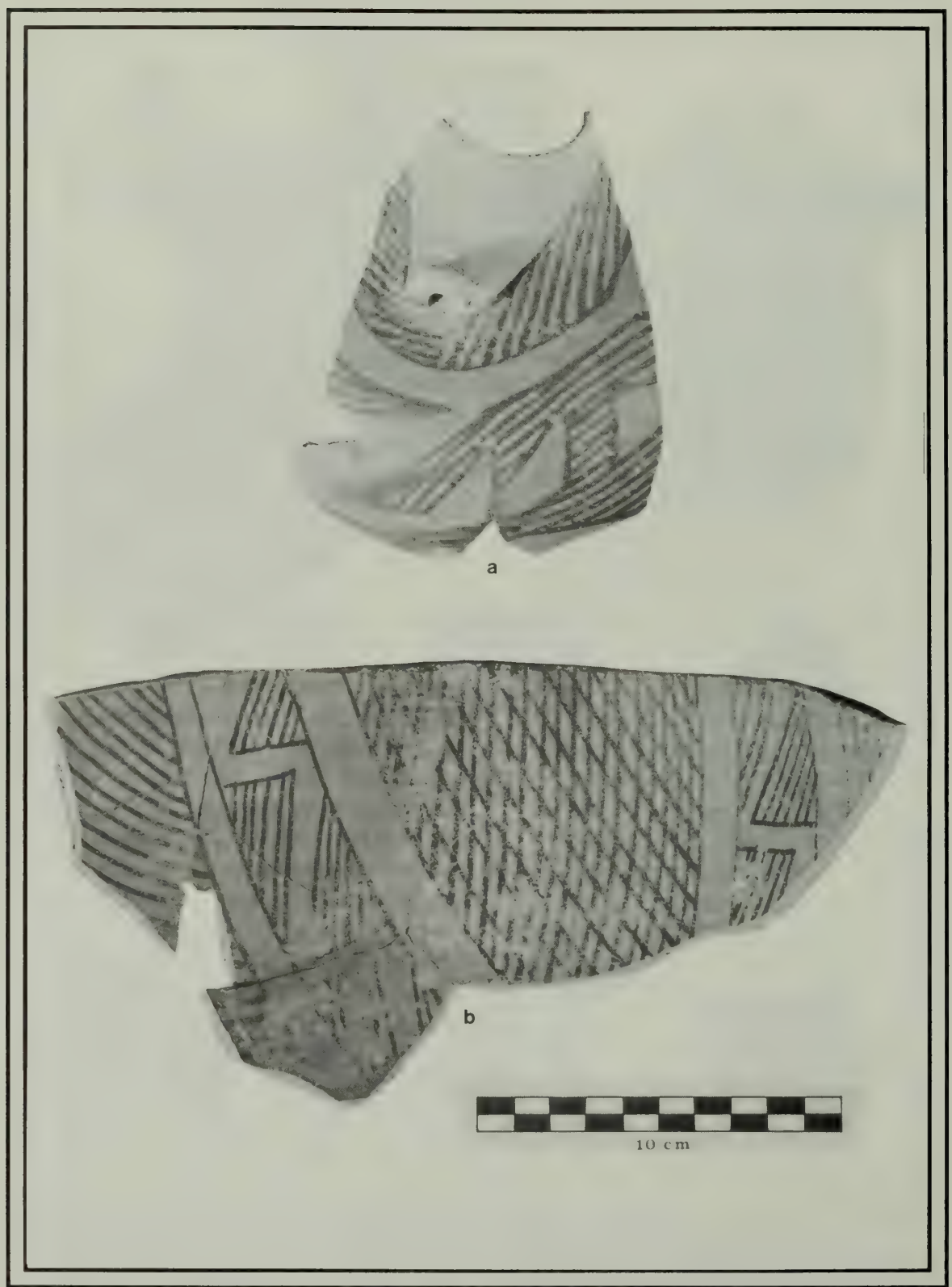


FIGURE 8.8. Tsegi Orange Ware: a-WUPA 3477, Cameron Polychrome, Style A; and b-WUPA 3624, Tusayan B/R.

painted plain ware. The Winslow area painted wares are almost three times more likely to be in the majority at sites, perhaps, as Colton has said, because the ware was made in the eastern part of the black sand area and is thus virtually a local ware.

Ceramic Artifacts (131)

Ceramic artifacts are broken down into two major categories, whole pots (4) and artifacts made from potsherds (127).

Four nearly complete pots were found during the survey. A Flagstaff Black-on-white bowl and a Moenkopi Corrugated pitcher, with handle, were found in a cache, Site WS 79. The reconstructed Black-on-white bowl was 115 mm high and 187 mm in diameter at the top. The pitcher is 160 mm high, 157 mm wide, and 95 mm at the neck area. It has an opening 103 mm in diameter and a handle 20 mm wide. A Citadel Polychrome vessel was found with a burial in a shelter site. A Tusayan Black-on-red jar, 140 mm high and 160 mm wide at the shoulder, was found eroding from the surface of another site; it has an opening 42 mm in diameter and a handle width of 8 mm.

A minimum of 127 artifacts were made on potsherds. The collection subdivides into five categories: handles (strap, lug, and dipper); spindle whorls (discs with large central holes); pendants (triangular, square, or round sherds with a hole at top); and worked sherds (often parts of discs, whorls, or pendants).

Twenty-four strap handles were found in at least 11 sites; 3 lug handles were identified; and 19 solid, pointed, dipper handles come from 13 sites. Finally, there were 24 unspecified handles from 14 sites. Thus a total of at least 70 handles of at least 3 different types were found in all sites of the survey, large and small.

Eleven spindle whorls, probably used for spinning cotton thread, were found at 9 sites. A slender rod would have been placed through the central hole, and the sherd would have acted as a counterweight.

Nineteen other disc-shaped sherds were found. They have either no hole at all or a hole much too small for a spindle whorl rod. Colton (1946:291, Figure 169) illustrates such a sherd with a fiber thong knotted and tied through it, thus making a button. Another explanation is that such unpierced discs were used as gambling pieces.

Three pierced sherd pieces were hung as pendants. They are generally triangular. While they are noted from only 2 sites, many more are probably included in the general "worded sherd" category.

Worked sherds are probably much more common than indicated by our figures, but at least 24 were identified from at least 21 sites. Many were probably intended as discs, whorls, or pendants.

Analysis of Data

Our consideration of the data will involve three problems: the creation and meaning of ceramic temporal and cultural periods; the question of whether excavated sites have the same types and percentages of pottery as surveyed sites; and the reliability of ceramic counts as compared to ceramic weight.

Ceramic Temporal and Cultural Periods

The 67 sites of our sample (Table 4) have been divided into categories of time periods, dates, and inferred cultural base, using both decorated ware and plainwares.

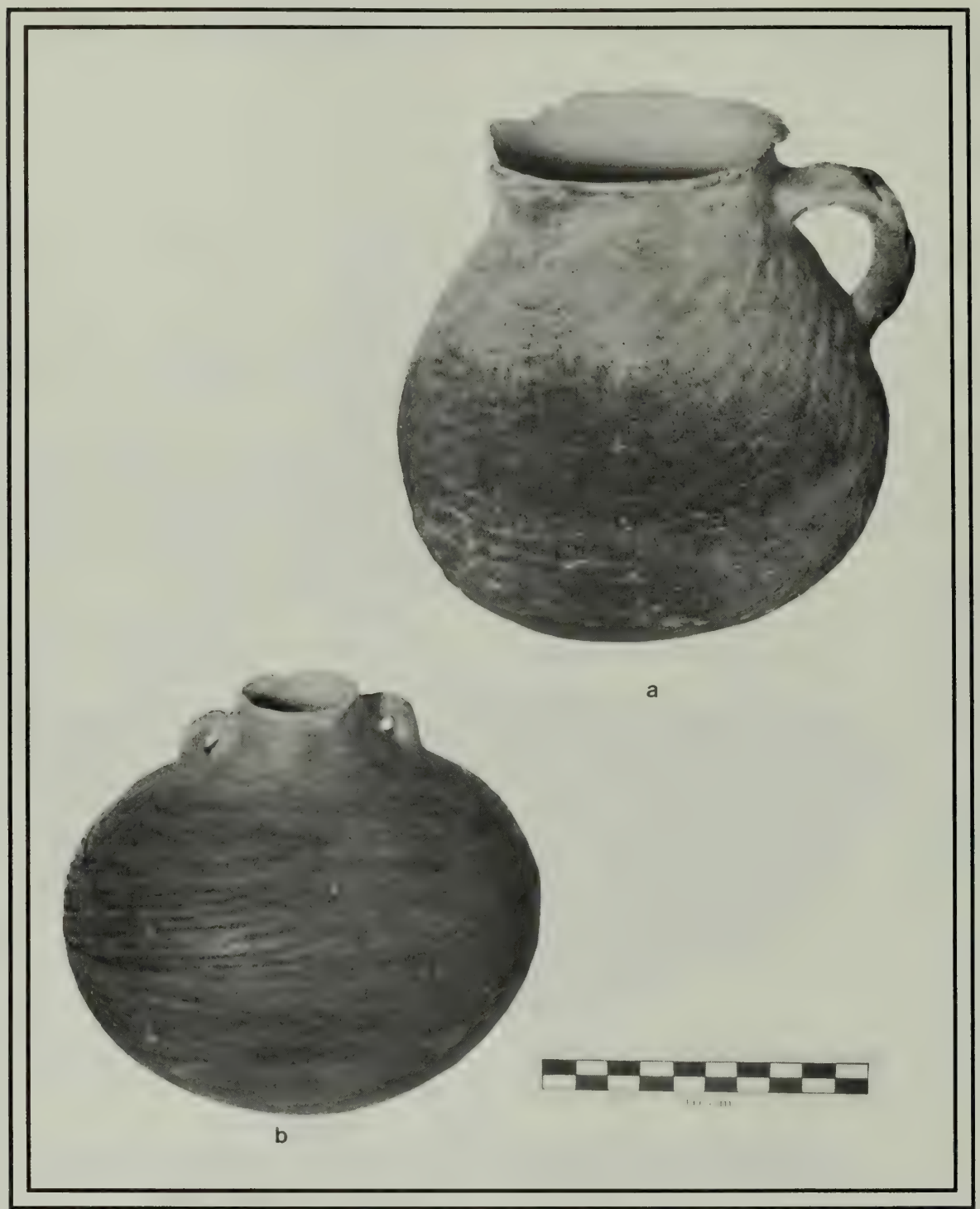


FIGURE 8.9. Complete Vessels: a-WUPA 3684, Moenkopi Corrugated Pitcher, greatest heigth: 161 mm, greatest diameter: 156 mm, diameter of opening: 80 mm, width of rim: 4 mm, width of handle: 20 mm, thickness of handle: 15 mm, colors vary from Hue 10YR 8/2 to Hue 5YR 7/4 to Hue 2.5Y 3/0; b-WUPA 3685, Tusayan B/R Canteen, greatest height: 143 mm, greatest diameter 162 mm, diameter of opening: 35 mm, width of rim: 4.7 mm, width of lugs: 8 mm/7 mm, diameter of lug openings: 7 mm/8 mm, color is Hue 10R 4/6.

FIGURE 8.10. Complete vessels: Different views of the same bowl, WUPA 3683, Flagstaff B/W restored vessel, greatest height: 120 mm, greatest diameter: 173 mm, width of rim: 5 mm,

figure 8.11. Restored Vessel: Tusayan Polychrome Bowl, WUPA 2426, greatest height: 135 mm, greatest width: 210 mm, diameter of opening: 198 mm, and rim width: 6 mm.

FIGURE 8.12. Worked Sherds: a-WUPA 3577 and b, c & d-WUPA 3660, gaming pieces; e-WUPA 3671, h-WUPA 3652, j-3680, and k- WUPA 3527, spindle whorls; others are f-WUPA 2412, g-WUPA 3678, and i-WUPA 3656.

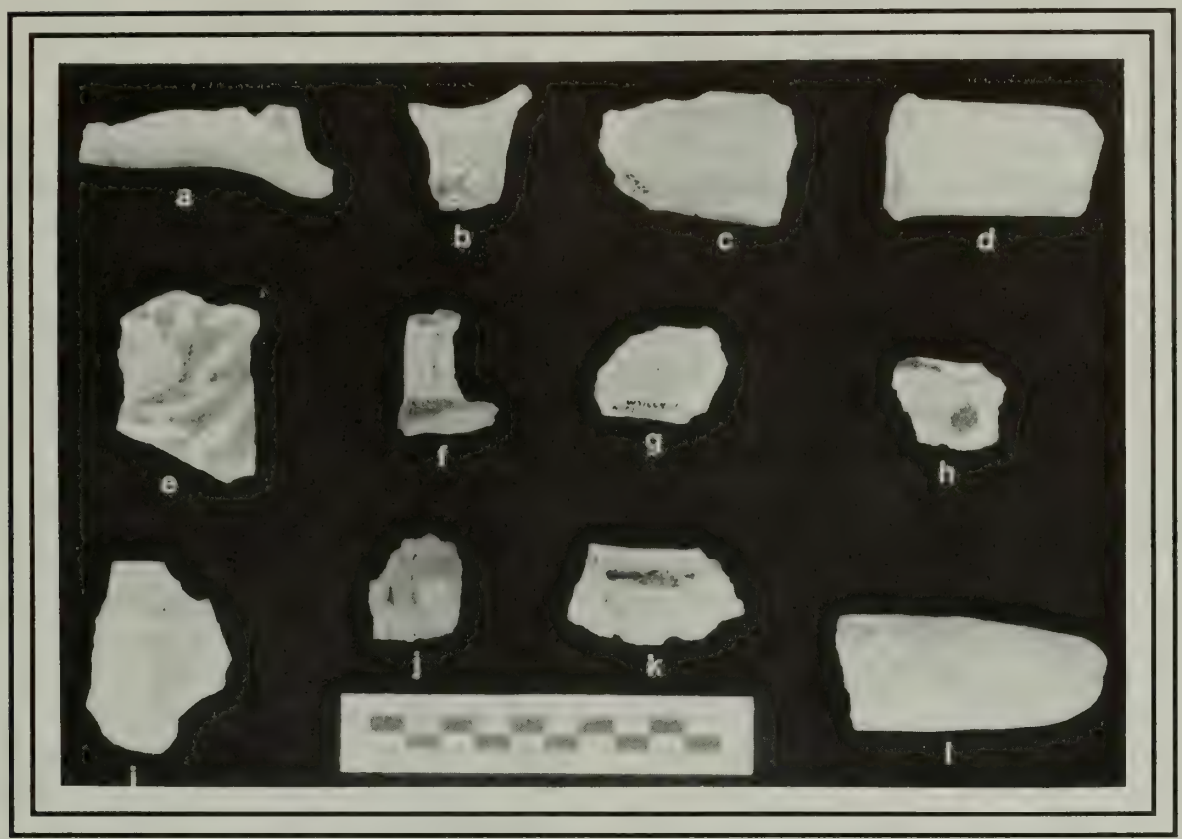


FIGURE 8.13. Ceramic handles. Ceramic Handles: a-WUPA 1969, b-WUPA 2211, C-WUPA 2220, d-WUPA 2221, e-WUPA 2260, f-WUPA 2447, g-WUPA 2213, h-WUPA 2214, i-WUPA 2425, j-WUPA 3564, k-WUPA 3626, and l-WUPA 3715; a,d, and l are ladles.

Time Periods

Time spans of occupation of the sites were calculated by using a modification of Colton's ceramic periods (Downum and Sullivan ; Table 4). In brief overview, by using associated and well-dated ceramic types, we may infer a sequence of ceramic periods of known time span and dates: (1) up to A.D. 1070; (2) A.D. 1070-1130; (3) A.D. 1130-1160; (4) A.D. 1160-1220: (5) A.D. 1220-1270; (6) A.D. 1270 on. The total number of the sites occupied during any one period or span of periods is indicated by the following list of ceramic periods of occupation, the first number(s) being the ceramic period or span of periods, the second number being the number of sites dated to such period or span of occupation:

1 = 0
2 = 0
2-3 = 1
2-4 = 7
2-5 = 3
3 = 0
3-4 = 31
3-5 = 9
4 = 4
4-5 = 11
5 = 0
6 = 1
TOTAL = 67 SITES

Considering only our sample of larger sites, there were thus 5 one-phase sites, 43 two-phase sites, and 19 three to four-phase sites. In brief, most (64%) Wupatki Monument larger sites had a life span of 100 years or less, and only 19 (28%) had possible life spans of as much as 120 years or more. The entire Monument span of occupation is probably no more than about 150 years.

To calculate the number of sites occupied during each single period we add the individual numbers of occupations during each of the ceramic periods:

1 = 0
2 = 11
3 = 49
4 = 65
5 = 23
6 = 1

The list of occupation periods of the larger sites thus indicates that there was no occupation prior to about A.D. 1070-1120, and probably closer to A.D. 1100; a slow rise in population to about 1130; a five-fold increase in population to A.D. 1160; a small increase (about 20%) during the next 60 years or so (the period of maximum population of the Monument, and of most of the larger sites); a rapid decline (by about 2/3) during the next few years; and abandonment, or at least the end of permanent occupation of the Monument sites, by about A.D. 1250. In fact, even the number of Period 5 site occupations may be deceptive, for many such occupations were only evidenced by a few potsherds dating after A.D. 1220. Such late occupations may have been short lived.

In any case, the dramatic population increase in less than 30 years suggest that it was caused by immigration and not internal population increase. Moreover, we are considering only those sites with 100 or more sherds, and these are almost all large sites (two rooms or more, with much pottery). Few of these could be classified as fieldhouses, which Pilles (1979:478-79) mentions as an alternate hypothesis to explain the apparent increase of occupied sites. Perhaps because of climatic change, soil improvement, or trade activity (my choice), the Wupatki area was clearly very attractive to members of at least four different potterymaking groups and, should the idea of index ware have any validity, to four different ethnic groups.

TABLE 8.4. Relative time periods for certain sites.

Sites	Colton's Time Periods	Dates (A.D.)	Decorated Wares	Plain Wares
WS 36	2-4	<1100-1200	Kayenta Anasazi, Little Colorado	Kayenta Anasazi
WS 37	3-4	1130-1200	Kayenta Anasazi,	Sinagua, Kayenta Anasazi
WS 100	2-4	<1100-1220+	Kayenta Anasazi, Little Colorado	Kayenta Anasazi, Cohonina
WS 112	2-4	<1100-1200	Kayenta Anasazi, Little Colorado	Kayenta Anasazi, Sinagua
WS 157	2-4	<1130-1200	Kayenta Anasazi, Little Colorado	Sinagua, Kayenta Anasazi
WS 165	3-4	<1130-1200	Kayenta Anasazi, Little Colorado	Kayenta Anasazi, Sinagua, Cohonina
WS 182	2-4	1100-1220+	Kayenta Anasazi, Little Colorado	Kayenta Anasazi
WS 204	6	ca. 1300		Hopi
WS 224	3-4	<1130-1220	Kayenta Anasazi	Kayenta Anasazi, Sinagua
WS 249	3-4	<1130-1200	Kayenta Anasazi, Little Colorado	Kayenta Anasazi, Cohonina
WS 323	3-5	<1130-1250+	Kayenta Anasazi	Kayenta Anasazi, Little Colorado
WS 328	3-4	1130-1200+	Kayenta Anasazi, Little Colorado	Kayenta Anasazi, Sinagua
WS 353	?3-4	1100+	Kayenta Anasazi, Little Colorado	Sinagua, Kayenta Anasazi
WS 356	3-4	<1130-1200	Kayenta Anasazi, Little Colorado	Kayenta Anasazi, Cohonina
WS 359	3-4	1130-1200	Kayenta Anasazi, Little Colorado	Kayenta Anasazi, Sinagua
WS 404	3-5	1130-1250+	Kayenta Anasazi, Little Colorado	Kayenta Anasazi, Sinagua
WS 459	3-4	1130-1200	Kayenta Anasazi, Little Colorado	Kayenta Anasazi, Cohonina

TABLE 8.4. (continued)

Sites	Colton's Time Periods	Dates (A.D.)	Decorated Wares	Plain Wares
WS 518	3-4?	1100-1150?	Kayenta Anasazi	Kayenta Anasazi, Cohonina
WS 519	3-5	1130-1250?	Kayenta Anasazi, Little Colorado	Kayenta Anasazi, Cohonina
WS 546	2-5	1100-1250?	Kayenta Anasazi, Little Colorado	Kayenta Anasazi, Cohonina
WS 590	3-4	<1130-1220	Kayenta Anasazi, Little Colorado	Kayenta Anasazi, Sinagua
WS 706	3-4	<1130-1220	Kayenta Anasazi, Little Colorado	Kayenta Anasazi
WS 709	3-4	<1130-1220+	Kayenta Anasazi	
WS 890	?2-3	1100-1150	Kayenta Anasazi,	Kayenta Anasazi, Sinagua, Cohonina
WS 892	3-4	1130-1200	Kayenta Anasazi	Kayenta Anasazi
WS 895	3-4	1130-1200	Kayenta Anasazi, Little Colorado	Kayenta Anasazi, Cohonina
WS 933	2-5?	1100-1250?	Kayenta Anasazi, Little Colorado	Kayenta Anasazi, Cohonina
WS 1023	3-4	1130-1200	Kayenta Anasazi	Kayenta Anasazi, Sinagua
WS 1027	4-5	1160-1250	Kayenta Anasazi	Kayenta Anasazi, Prescott
WS 1042	4-5	1150-1250	Kayenta Anasazi	Kayenta Anasazi, Cohonina
WS 1043	4-5	1150-1250	Kayenta Anasazi, Little Colorado	Kayenta Anasazi
WS 1059	4-5	1200-1250	Kayenta Anasazi, Little Colorado	Kayenta Anasazi
WS 1061	4+	1160-1220	Kayenta Anasazi, Little Colorado	Kayenta Anasazi
WS 1067	4-5	1160-1250	Kayenta Anasazi	Kayenta Anasazi
WS 1089	3-5	1130-1250+	Kayenta Anasazi, Little Colorado	Kayenta Anasazi, Sinagua, Prescott

TABLE 8.4. (continued)

Sites	Colton's Time Periods	Dates (A.D.)	Decorated Wares	Plain Wares
WS 1096	4-5?	1160-1220+	Kayenta Anasazi, Little Colorado	Kayenta Anasazi
WS 1107	3-4	1130-1200	Kayenta Anasazi, Little Colorado	Kayenta Anasazi, Sinagua, Cohonina
WS 1109	4	1160-1200	Kayenta Anasazi, Little Colorado	Kayenta Anasazi, Sinagua
WS 1111	3-5	1130-1250	Kayenta Anasazi, Little Colorado	Kayenta Anasazi, Prescott
WS 1132	4-5	1160-1250	Kayenta Anasazi, Little Colorado	Kayenta Anasazi,
WS 1213	4	1130-1160	Kayenta Anasazi	Kayenta Anasazi, Prescott
WS 1258	4-5	1130-1250	Kayenta Anasazi	Kayenta Anasazi, Prescott
WS 1295	4-5	1130-1220+	Kayenta Anasazi	Kayenta Anasazi, Prescott
WS 1356	3-4+	1130-1220+	Kayenta Anasazi, Little Colorado	Kayenta Anasazi
WS 1357	3-4	1130-1200	Kayenta Anasazi, Little Colorado	Kayenta Anasazi, Sinagua
WS 1361	3-4	1130-1200	Kayenta Anasazi, Little Colorado	Kayenta Anasazi
WS 1378	3-4	1130-1200	Kayenta Anasazi, Little Colorado	Kayenta Anasazi, Sinagua, Cohonina
WS 1395	3-5?	1130-1230?	Kayenta Anasazi	Sinagua, Kayenta Anasazi
WS 1400	4-5	1160-1250	Kayenta Anasazi, Little Colorado	Sinagua, Kayenta Anasazi
WS 1432	3-4	1130-1200	Kayenta Anasazi, Little Colorado	Sinagua, Kayenta Anasazi
WS 1467	?2-4	1100-1220	Kayenta Anasazi	Kayenta Anasazi
WS 1556	3-5	1130-1250	Kayenta Anasazi, Little Colorado	Kayenta Anasazi, Prescott

TABLE 8.4. (concluded)

Sites	Colton's Time Periods	Dates (A.D.)	Decorated Wares	Plain Wares
WS 1630	3-5	1130-1250	Kayenta Anasazi, Little Colorado	Kayenta Anasazi, Cohonina
WS 1635	3-4	1130-1220+	Kayenta Anasazi, Little Colorado	Kayenta Anasazi, Prescott
WS 1654	3-4	1130-1200	Kayenta Anasazi	
WS 1664	2-5	1100-1230	Kayenta Anasazi, Little Colorado	Kayenta Anasazi, Prescott
WS 1801	3-4	1130-1220	Kayenta Anasazi, Little Colorado	Kayenta Anasazi
WS 1853	3-4	1130-1200	Kayenta Anasazi, Little Colorado	Kayenta Anasazi, Sinagua
WS 1864	3-5	1130-1230	Kayenta Anasazi, Little Colorado	Kayenta Anasazi, Sinagua
WS 1980	4-5	1130-1250	Kayenta Anasazi, Little Colorado	Kayenta Anasazi
WS 1992(1)	3-4	1130-1200	Kayenta Anasazi	
WS 1992(2)	4	1160-1220		Sinagua
WS 1998	3-4	1130-1220	Kayenta Anasazi, Little Colorado	Kayenta Anasazi, Sinagua
WS 2001	3-5	1130-1250	Kayenta Anasazi, Little Colorado	Kayenta Anasazi
WS 2002	3-5	1130-1250	Kayenta Anasazi, Little Colorado	Kayenta Anasazi, Prescott
WS 2285	4	1160-1200		Sinagua
WS 2294	3-4	1130-1200	Kayenta Anasazi, Little Colorado	Sinagua

One possible explanation for this population spurt and trade activity is that this is the period of the collapse of the Toltec trading empire to the south, and the time of the rapid decline or collapse of the possibly related Chaco trading empire and its outliers to the east. Casas Grandes, on the other hand, was just beginning its greatest period of development and expansion, perhaps shifting trade routes more to the east and west, and thus into the Hohokam, and Sinagua areas. (The Rio Grande cultures were only beginning to develop by A.D. 1150). Thus it might be postulated that the stimulus to Wupatki Monument population buildup between A.D. 1150 and 1200 was the importance of new trade centers here and in the closely related Flagstaff and Hopi Mesa zones, which were also in contact with the Hohokam, and ultimately, Casas Grandes.

Cultural Periods

If we make use of both the plain ware and decorated ceramics to judge cultural base, or trade, our conclusions would be the following (Table 4, columns 3-4):

Decorated Wares. Judging by decorated wares alone, all the sites would either be Anasazi in trade wares or origin. The breakdown is as follows:

No data = 2
Anasazi/Prescott = 1
Anasazi/Kayenta = 18
Anasazi/Little Colorado (Winslow) = 46

The results indicate that the people of 69% of the larger sites were receiving their major decorated ware from Little Colorado (Winslow) area communities in the east of the black sand area or were immigrants from this zone; and only 28% of the people of the larger sites were making their major ware or trading for it with the Kayenta Anasazi. This last fact is particularly interesting, because we know that more Tusayan White pottery, in total, was made or traded than any other ware.

Plain Ware. The unpainted pottery tells a similar but slightly different story. Again, most of the sites (55 = 82%) have a majority of Anasazi wares,(3-4.5%) have no majority ware, and(9-13.5%) have a majority of Sinagua Brown ware. In addition, 17 sites have a strong Sinagua minority representation, while most other sites have a strong Anasazi minority mixture (Tables 1 and 4). However, a new feature of the plain ware assemblages is that the Cohonina (11-16%) and Prescott (9-13%) wares and types are strongly represented in some sites, at least at the minority level. One Little Colorado plain ware site (WS 323) was also identified. Mixed minority assemblages include 4 (6%) Sinagua and Cohonina; and 1 Prescott and Sinagua.

For the most part, the Sinagua units are found to the south-central and southeast (Wupatki) zones; while Cohonina and Prescott assemblages are located in the west of the Monument area. The plain ware results thus indicate a stronger Sinagua presence, as well as a higher degree of Prescott and Cohonina presence, than do the decorated wares; but their distribution is much the same as that of the painted pottery, that is, Prescott and Cohonina settlements to the west, Sinagua to the south and southeast, and Anasazi scattered throughout the Monument area (see Downum and Sullivan, this volume, or Travis, this Volume, for additional discussions, statistics, and maps demonstrating these geographical clusters).

Comparison of Percentages of Pottery from Excavated and Surveyed Sites

A comparison of the variability of ceramic type and ware percentages was made between the excavated and surveyed ceramic samples. Table 3, which summarizes the material in Tables 1 and 2, includes the totals of the pottery from the 67 sites in the Wupakti survey sample and the totals of our sample of 12 previously excavated sites in the Monument area. Some interesting differences are revealed.

Painted Ceramics

Overall, painted pottery constituted about 36% of the total pottery in surveyed sites, but only 25% in the excavated site sample. In the Tusayan White category, Black Mesa, and Shato, while rare, are more common in excavated than in surveyed sites (e.g., Black Mesa was found in a percentage of 0.210 in surveyed sites and 0.50 in excavated sites). Dogoszhi is 1.5 times more common in excavated sites; Sosi about equal. Flagstaff is twice as common in excavated sites than in surveyed sites, while Wupatki is eight times more common in excavated sites. This last figure, however, is probably due to the exceptional amount of Wupatki found at Wupakti Pueblo itself, where any pottery seeming to fall in the Tusayan category is called Wupatki. Thus, there is too little Tusayan represented or, rather, too much Tusayan called Wupatki -- the types do intergrade. A more accurate comparison, then, would be between the total of what we have called Wupatki, Tusayan, and Wupatki/Tusayan, and the same categories from the other sites. When this is done, the comparison of the combination of all three of these later categories produces a much closer balance (a 4:3 ratio). In short, both earlier and later Tusayan types are more common in excavated sites. I would suggest that this is due to the skew effect produced by the very large amounts of pottery at Wupatki Pueblo.

Little Colorado White wares, in total, are only one-fifth as common in excavated sites as in surveyed ones. Early forms such as Holbrook, Padre, and Chevelon, although relatively rare, are again much more common in surveyed sites (1.67% and 0.12%); later types are more in line. Walnut is only about 40% less common in excavated types, and Leupp, although not even mentioned in excavated sites, represented by only 31 sherds in the survey collections. In short, Little Colorado White is five times more common in our surveyed sites than in the excavated sites sample, and early types are more common in particular.

Tsegi Orange wares are less common in surveyed sites (the ratio is about 2:3), but individual types vary widely. Medicine Black-on-red is rare in both types of sites; but Tusayan Black-on-red is five times more common in excavated sites. Citadel and Tusayan Polychrome varieties are about four times more common in excavated sites. Thus, in this variety of painted Anasazi pottery, excavated sites again had higher percentages than surveyed sites, particularly in the later types.

Among the more rare painted types, St John's Polychrome and Showlow Black-on-red are much more common in excavated sites; while Tuzigoot and Cibola types are only found in surveyed sites.

I would infer that the explanation for the generally greater occurrence of painted types in surveyed sites would be the preference in survey collection for the more easily seen and better-dated painted types.

However, the percentages of the individual painted wares, when compared, also indicates that Kayenta wares (Tusayan White and Tsegi Orange) are more common in excavated sites, while Little Colorado ware is more common in surveyed sites. In general, Little Colorado ware early types are more common in surveyed sites, and late types are more common in excavated sites, perhaps due to the skew affect of the large amount of late pottery from Wupatki Pueblo.

Plain Wares

About 76% of the total pottery of the excavated sites is plain ware, as contrasted to surveyed sites, which had about 64%. Less variation occurs among the plain ware percentages, but Moenkopi Corrugated is 1.5 times more common in surveyed sites, while Tusayan Corrugated, while more nearly equal, is the reverse (suggesting classification differences). Brown wares are twice as common in excavated sites, probably due to the large quantity and percentage found at Wupatki. Winona/Youngs varieties are 1.5 times as common in excavated sites and Sunset varieties twice as common, but Turkey Hill Red 8 times as common.

San Francisco Mountain Gray wares are much more common (5 times) in excavated sites, as well. Plain types are 5 times more prevalent, and fugitive red as many as 7 times more common. The reverse is true when considering the Prescott Gray wares, which are nearly to 4 times more common in surveyed sites. The black/gray variety is up to 20 times more common, perhaps because such wares are more common in small villages.

Minor wares, such as Elden Corrugated, vary: Elden is nearly 2 times more common in the excavated sites, and others, such as Flagstaff Red and Linden Corrugated, are only found in excavated sites; while the post-A.D. 1300 Hopi wares, painted or plain, are only found in the surveyed sites.

In general, then, there is considerable variance among excavated and surveyed ceramic samples. In total, painted types are more common in surveyed sites, perhaps due to selective potsherd collection, and it is interesting that Little Colorado types are particularly common in surveyed sites. Is this due to differences in classification or the higher visibility of the Little Colorado types? And how does one explain the greater amounts of San Francisco Mountain Gray wares (Cohonina pottery) in excavated sites and the greater amounts of Prescott Gray wares in surveyed sites?

Percentages of Counts and Weights Compared

Previous work done by King (1949:110) at Nalakihu, in the Citadel area, and by Watson Smith (1952:83-106) in Big Hawk Valley, in the far western area, indicate that the relative popularity of pottery types remains about the same whether one uses percentages by count or weight. When some variation in order does take place, the percentage differences are usually not more than 2-5%. A spot check of our data indicates much the same result. It makes only a minor amount of difference whether one measures one way or another, although the smaller the sample, the higher the probable variation. In the analysis of any large group of sherds of the same types, then, either method would be acceptable, and the weight method is quicker. Most surveys involve such a small number of sherds per unit, however, that weighing sherds does not appear to be useful.

Conclusions

The ceramic data as correlated with settlement units indicate that there was a major increase in sites and, by inference, population between A.D. 1130 and 1160; that the sites involved in our sample were mainly larger ones and not, for the most part, possible fieldhouses; and that site occupation increased by 5-6 times, far more than could be explained for a 30 year period by internal growth. The major question that must still be answered is whether the so-called index plain wares were actually manufactured in the cultural zones claimed by Colton or whether they were also manufactured elsewhere. The same problem affects our understanding of the decorated wares and their meaning. Are they actually trade wares? We need some good trace element and chemical analysis of these pottery wares, as is currently being done for Rio Grande ceramics by scientists at Los Alamos. In any case, Kayenta Anasazi pottery was most often traded, or made, in total; but Little Colorado White ware was most often found in the majority at individual sites.

Plain ware analysis also indicates that most sites are identified as Kayenta, but a slightly more common Sinagua and Prescott emphasis is noticeable in the plain ware ceramic collections that I have emphasized, when compared to the figures of Downum and Sullivan. We all agree, however, that the Prescott and Cohonina sites are found in the west, the Sinagua sites are found in the south and east, and the Kayenta sites are found throughout the Monument. A trace of a post-Sinagua Hopi presence can also be noted. Very little trade seems to have come from more distant areas outside of the Monument. Only a hint of Zuni or White Mountain area ceramics are found, and but a handful of Hohokam sherds. Ceramic artifacts are quite rare, and they are limited to those made on potsherds--pendants, discs, and whorls.

Finally, in our consideration of some theoretical problems, we have noticed that percentages of pottery from surveyed and excavated sites do vary. In general, less Tusayan and Tsegi is found in surveyed sites, and more Little Colorado White is typical. Some specific plain wares, such as Turkey Hill Red and Elden Corrugated, are more common in excavated sites, as is San Francisco Mountain Gray; but for some unknown reason, Prescott Gray is more common in surveyed sites.

Measuring by weight or count produced much the same results. Weight would be more practical for measuring large numbers of sherds, but count still seems to be more practical for the average site or survey analysis.

Chapter 9

WUPATKI ROCK ART

By Bruce A. Anderson

Background

Within and on red sandstone mesas, in yellow limestone canyons, and around black basalt escarpments, the rock art of Wupatki National Monument is as intriguing as the geologic formations upon which it is found. The Archeological Inventory Survey Project located a total of 132 sites containing petroglyphs, or pecked and incised figures (see Table 9.1 for a listing of the sites, the number of panels, and the number of elements found at each site). Figure 9.2 shows the distribution of rock-art sites throughout Wupatki National Monument. Two additional sites that are shown to the north of the monument's boundary (not included in Table 9.1) are now part of the Spider Web Ranch and the Navajo Indian Reservation but will be discussed within this chapter. There are more than 1,838 individual elements found on the 455 rock-art panels inventoried, which illustrates the magnitude, and variety of this cultural resource. The sites range in

FIGURE 9.1. WS-834, Panel 30 - Anthropomorph, with big feet.

TABLE 9.1. Listing of the Rock Art Sites found at Wupatki National Monument.

Site	No. of Panels	No. of Elements	Site	No. of Panels	No. of Elements	Sites	No. of Panels	No. of Elements	Sites	No. of Panels	No. of Elements
Prehistoric Rock Art Sites:											
WS-80	3	Unk	WS-694	1	Unk	WS-1383	1	1	WS-1739	3	17
WS-81	4	Unk	WS-783	1	5	WS-1395	1	1	WS-1741	1	2
WS-105	3	11	WS-785	1	14	WS-1437	1	8	WS-1763	1	1
WS-112	7	16	WS-835	4	26	WS-1445	4	9	WS-1764	1	1
WS-113	1	1	WS-838	9	37+	WS-1452	1	3	WS-1803	1	3
WS-119	1	15	WS-839	4	25	WS-1460	1	1	WS-1834	2	7
WS-128	1	5	WS-884	3	10	WS-1556	2	12	WS-1835	1	1
WS-153	2	Unk	WS-889	1	Unk	WS-1562	1	1	WS-1929	1	11
WS-155	4	8	WS-898	2	2	WS-1571	1	Unk	WS-2039	2	29
WS-156	11	Unk	WS-950	1	1	WS-1605	1	1	WS-2054	2	2
WS-158	2	5	WS-951	9	Unk	WS-1624	1	1	WS-2056	19	95
WS-159	5	Unk	WS-952	2	2	WS-1635	2	2	WS-2121	3	17
WS-160	15	25	WS-1042	2	6	WS-1636	5	12+	WS-2176	2	3
WS-161	11	Unk	WS-1071	5	23	WS-1639	1	16	WS-2178	1	18
WS-300	1	1	WS-1107	1	1	WS-1645	2	11	WS-2179	6	14
WS-301	4	31	WS-1162	1	1	WS-1652	2	5	WS-2237	3	Unk
WS-380	1	13	WS-1177	1	3	WS-1654	1	3	WS-2364	2	2
WS-493	2	2	WS-1184	1	1	WS-1678	1	4	WS-2434	1	6
WS-537	3	Unk	WS-1243	4	9	WS-1688	3	31	WS-2478	4	19
WS-616	5	11	WS-1290	1	6	WS-1718	2	Unk	WS-2559	1	3
WS-660	1	2	WS-1366	1	1	WS-1736	2	Unk			
Rock Art Sites With Both Prehistoric and Historic Elements:											
WS-308	2	19	WS-834	72	436+	WS-1677	1	4	WS-1802	1	97+
WS-775	2	34	WS-1578	5	5	WS-1747	1	19	WS-1808	6	33
WS-831	16	155	WS-1634	27	Unk	WS-1762	5	47	WS-1815	4	Unk
WS-833	19	189+	WS-1660	7	14+	WS-1767	2	21	WS-1845	7	Unk
Navajo Rock Art:											
WS-294*	1	1	WS-745*			WS-1019*			WS-1858*	1	1
WS-653	5	18+	WS-748	1	1	WS-1467	2	2	WS-2301*	2	2
WS-720	1	1	WS-759*			WS-1689*	1	1	WS-2303	4	8
WS-728*			WS-772	1	2	WS-1692*	2	Unk	WS-2305	1	1
WS-732	3	11	WS-777*			WS-1769	1	16	WS-2309	3	13
WS-737*			WS-805*			WS-1770	1	2	WS-2333*	1	Unk
WS-740*			WS-819	2	10	WS-1843	1	5	WS-2341*	1	2
WS-742	2	5	WS-836	1	1	WS-1848*	1	Unk	WS-2342	2	2
									WS-2423	2	8

*Non-art (initials, scratches, etc.).

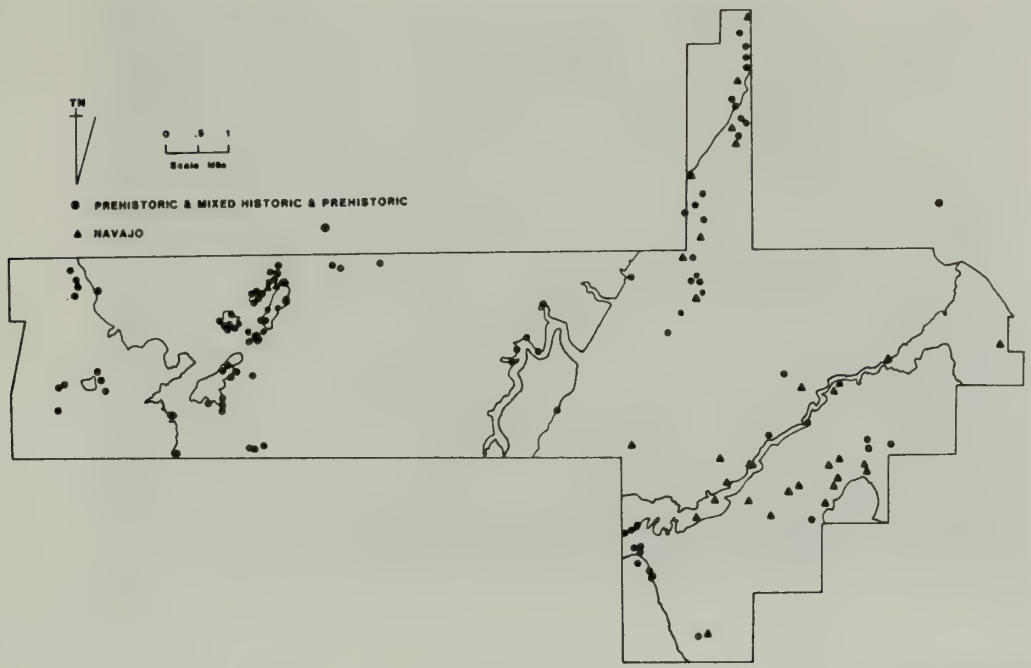


FIGURE 9.2. An illustration of the distribution of rock art sites found within Wupatki National Monument.

size from a single area of undetermined pecking or incising to WS-834 (Horseshoe Mesa), with 72 panels and over 436 individual elements. Within this chapter, emphasis will be placed on preservation, previous research, interpretation, recording of individual elements, and suggestions for future research of the rock art resources.

Rock art was an important component of all the cultural resources under consideration within the Archeological Inventory Survey Project (Anderson 1982:8, 12, 1983:6, 8, 1984:4, 9, 1986:4, 6, and 1987:4, 6, Anderson and McKenna 1985:4, 7). The suggestion that rockart panels be treated as features within the archeological site (Stuart 1978:185, 196), was followed. Elements and panels were a part of the six-page site form, which included locational information, archeological context, environ-

FIGURE 9.3. WS-835, Panel 4 - realistic pronghorn Antelope.

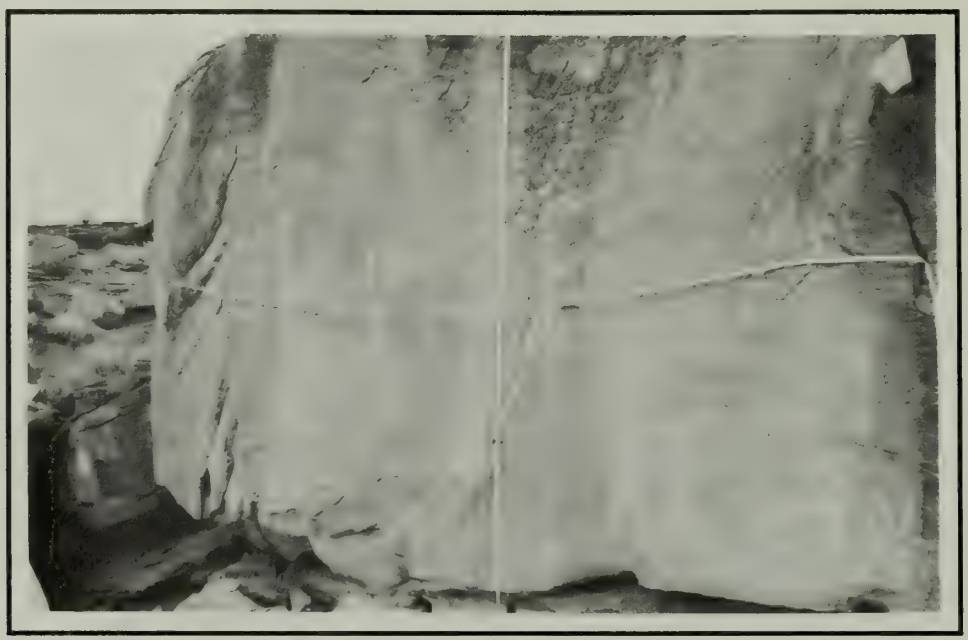


FIGURE 9.4. WS-775, Panel 1. Recording rock art sites: the metric tapes are utilized to provide measured drawings. This panel has both historic and prehistoric elements.

FIGURE 9.5. WS-831, Panel 11 : Long-necked bird, which may be a goose.

mental information, and other aspects of the site. All the 455 rock art panels were photographed, and many were drawn to scale. This is not to say, however, that the recording procedures fully met the standards set by the American Committee to Advance the Study of Petroglyphs and Pictographs (Swartz 1981: 94-95), as there was not sufficient time during the survey process to do so. Further, some of these numerous measurements may be without theoretical justification, or without great import to rock-art studies. As Schaafsma says, "It is a basic assumption that rock art will be located in a patterned way in relationship to both the landscape and other cultural remains, as it is integrated with a variety of specific activities that are in themselves presumed to be nonrandom" (1985:241). This certainly was the case for the bulk of the Wupatki National Monument rock-art sites.

FIGURE 9.6. WS-1802, Panel 1. Recording a rock art site.

FIGURE 9.7. WS-1107, Panel 1. Heavily eroded spiral.

FIGURE 9.8. WS-1290 - Stylized lizard located near an enclosure.

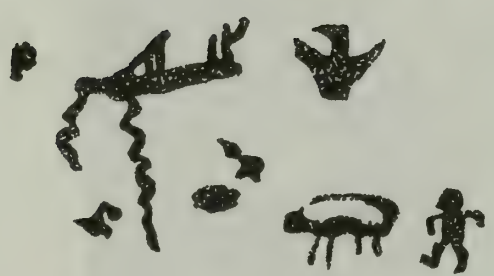


FIGURE 9.9. WS-831, Panel 13 - A group of figures that appear to represent a story, located by the entrance to the upper rooms at Crack-in-Rock Pueblo.

The preservation and protection of rock-art sites, which are very important to the National Park Service, are best achieved by the inclusion of the sites within national monuments and parks (Grant 1967:78). Erosional factors such as the percolation of water and the scouring effect of windblown sand can contribute to the destruction of rock art (Schaafsma 1966:27-29; Grant 1967:74). These natural forces are part of a gradual process and are inevitable, but of greater concern are the damages inflicted by humans. These can include pecking, incising, writing, and painting names and dates over existing designs; chalking and scratching elements for photographic purposes; shooting depicted figures; and direct defacing by chiseling and spray painting (Schaafsma 1966:29-30; Grant 1967:76). Senseless vandalism, which can totally destroy this fragile, nonrenewable cultural resource, is the primary reason why many of the remote rock-art sites are closed to the general public and many others require guided entrance for viewing.

Whether the artist chose to cut into the stone or to paint on its surface depended on the local geology and the type of stone being utilized (Bain 1970:5; Grant 1978:155). Generally, paintings occur on light-colored rock in well-sheltered locations, and this probably was the preferred technique (Grant 1978:155-156). When the survey process began, it was hoped that there would be numerous pictographs at Wupatki. Other than a few red smudges or remnants of paintings, however, only one recognizable element was located. A white figure, probably of kaolin-type paint, was found at WS-2056 (see Figure 9.10). This is a double-ended or mirror figure, and is similar to one illustrated for site CDM-2 in Canyon de Chelly National Monument (Grant 1978:197). The Wupatki element

FIGURE 9.10. WS-2056, Panel R. The only recognizable pictograph found at Wupatki National Monument.

was located on the back wall of a rock shelter, within a limestone exposure. Because most of the sites are located on sandstone or basalt exposures, which tend to be darker with more exposed surfaces, petroglyphs evidently became a preferred method for the prehistoric Wupatki residents.

Work and descriptions of the rock art at Wupatki National Monument prior to the survey are confined to the efforts of the following ten individuals. In his discussion of sites around Citadel Ruin, Samuel A. Barrett noted the occurrences of petroglyphs around three sites and mentioned that some were "realistic animal figures, while others are apparently intended merely as geometric designs" (1926:27, 32, 57). Jimmie and Sallie Brewer illustrated and discussed some of the design elements found in the Wupatki area (1935a:129-132). The primary purpose of both of these early examples was to indicate the presence of rock art at Wupatki

FIGURE 9.11. WS-2056, Panel G - Stylized swastika, which is probably a ceramic design.

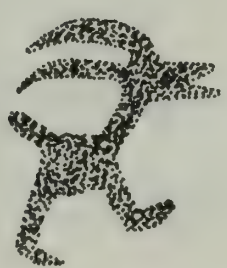


FIGURE 9.12. WS-81 - A classic bighorn sheep.

FIGURE 9.13. WS-1769 - Navajo rock art, with both pecked and incised figures on large sandstone slabs near prehistoric rooms.

FIGURE 9.14. WS-1770 - Historic Navajo horse and mesa on a large sandstone slab lying on the ground.

National Monument. One rock-art area, Inscription Point, located on the Navajo Indian Reservation just north and east of the Wupatki National Monument boundary, has been discussed at length (Colton 1946b:5-6, 1960:83; Davin and Dolphin 1973:1-8). In 1933, Charlie Steen recorded 12 sites in the Citadel area which contained petroglyphs and included predominately geometric and zoomorphic figures (1949:162). At NA-696, located just north of the monument boundary on the Spider Web Ranch, an intricate geometric design was located (162). An illustration of this site's design is utilized by Polly Schaafsma, who suggested that it is a textile design (1987:20). A visitor to Wupatki National Monument, David P. Rothrock, left a note for the files on a very weathered petroglyph near Wupatki Ruin, which he attempted to interpret (1976:1-3). This particular panel, located on a horizontal sandstone surface, and is part of WS-1384, which is heavily eroded and presently does not contain all of the elements described by Mr. Rothrock. William Van der Ven surveyed and photographed a number of petroglyph sites in the Citadel area (1977:1-69). And finally, Hans Bertsch discussed some petroglyphs near Lomaki Ruin, which he considered to be possible Hohokam petroglyph sites (1985:63-64). The photograph for Figure 19 (70) is of Panel 3 of WS-1688, and for Figure 21 (71) is of Panel A of WS-1736. I will discuss the fact that I do not consider these elements to be Hohokam in the interpretation section of this chapter.

Before considering some of the interpretations given for various rock-art motifs, it is necessary to define how some researchers have approached the definition of "style" and are able to assign relative dates to rock art. The determination of a particular style is based on a certain set of

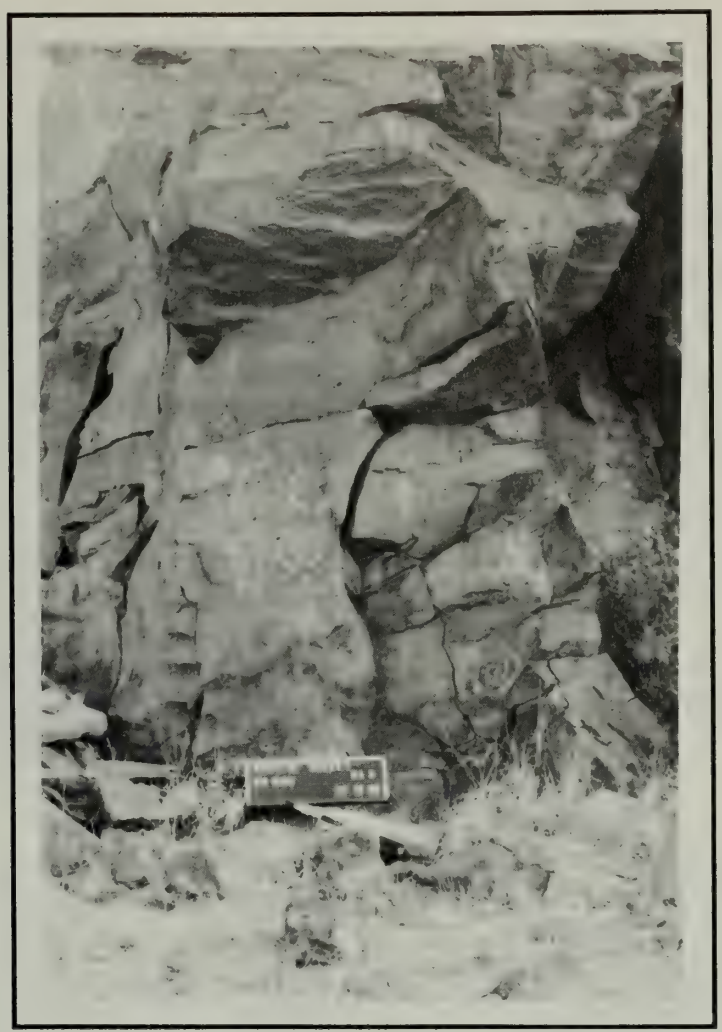


FIGURE 9.15. WS-1688, Panel 3. Grouping of elements that Hans Bertsch believes are Hohokam (1985:70). They are similiar to other Kayenta Anasazi rock art panels.

FIGURE 9.16. WS-1243, Panel 1 - Figure may be a horned Kokopelli.

FIGURE 9.17. WS-1739, Panel B - Another anthropomorph.

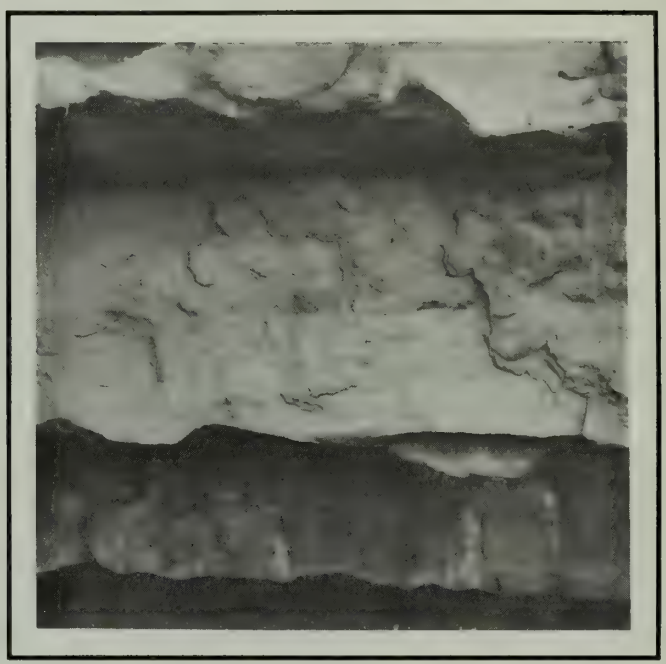


FIGURE 9.18. WS-380, Panel 1. Various elements pecked into limestone, above a small shelter.

FIGURE 9.19. WS-1445, Petroglyph 2 - Realistic snake.

forms, with only a limited number of possible graphic expressions being utilized (Schaafsma 1985: 246). These forms, or designs, can be referred to as a "type" of element, but the term "style" is all-encompassing (247). Thus, a rock-art style can be viewed as a shared visual system, which reinforces cultural identity and functions as a means of social interaction (263). This concept of style can also be applied to the dating of the elements present:

Often one design has been pecked over another--the superimposed drawing done later than the partially obliterated underdrawing. Sometimes three or more designs in differing styles are layered in a recognizable sequence. Patination and weathering are useful additional clues to separate these multiple superimpositions. Once the sequence of styles has been established, a yardstick is created to judge relative chronology of styles anywhere in the

region, even where no superimposition occurs [Grant 1967:45].

Rock art can also be dated by association with artifacts, by ethnographic identification, and by the subject matter depicted (48-53). In the Southwest, rock art is frequently associated with habitation sites that can be placed within a specific time frame by the pottery types present at these sites (Schaafsma 1980:15). Petroglyph pattern designs can be compared with decoration designs on prehistoric pottery and textile fragments to provide another means to date rock art (Schaafsma 1987:23). At Willow Springs near Tuba City, Arizona, and north of Wupatki National Monument, a Hopi informant identified several petroglyphs as Hopi clan symbols (Colton and Colton 1931:32-37). At Chavez Pass, southeast of Wupatki, this large Sinagua site (now known as Nuvakwewtaga) has masked petroglyphs that may represent kachinas or other masked personages present at Hopi

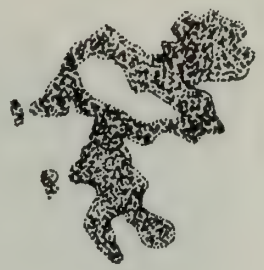


FIGURE 9.20. WS-1763 - Anthropomorphic form.

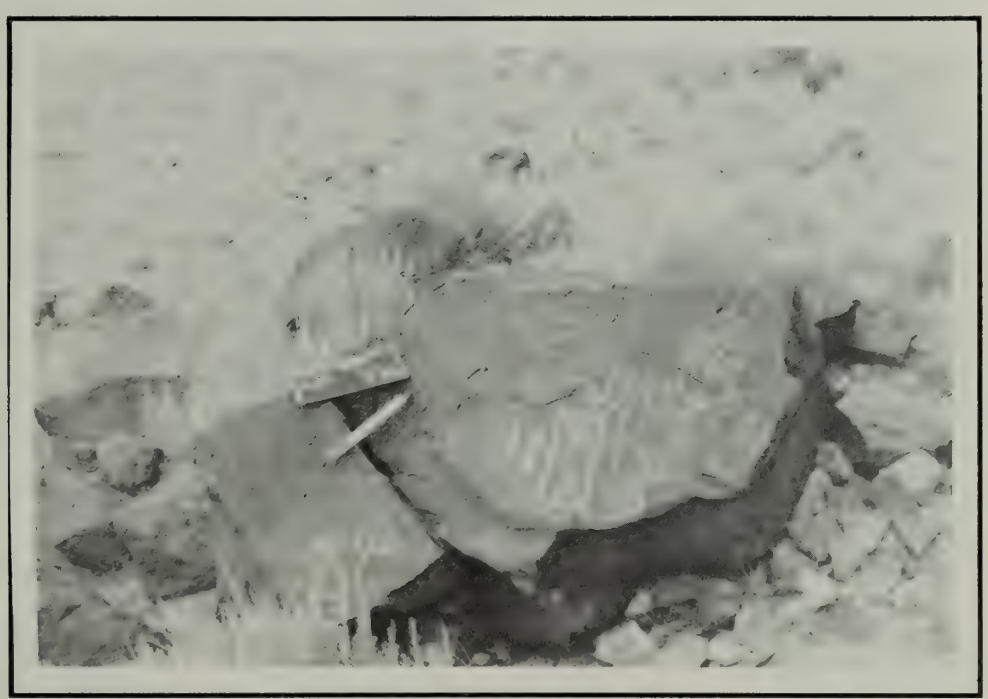


FIGURE 9.21. WS-1636, Panels 3 & 4. Petroglyphs pecked onto large basalt boulders

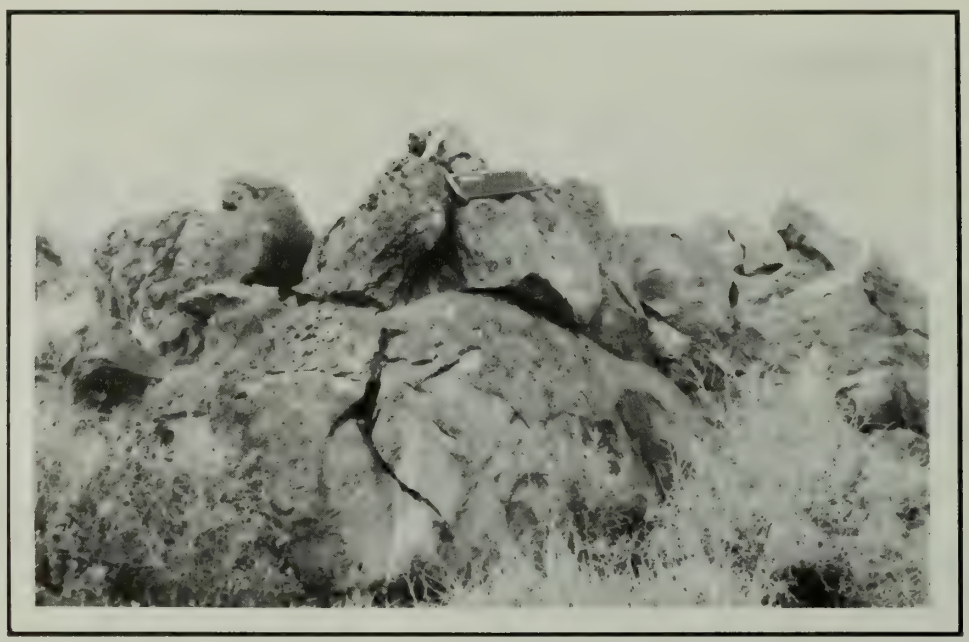


FIGURE 9.22. WS-1177, Panel 1. Geometric designs pecked on a basalt outcrop.

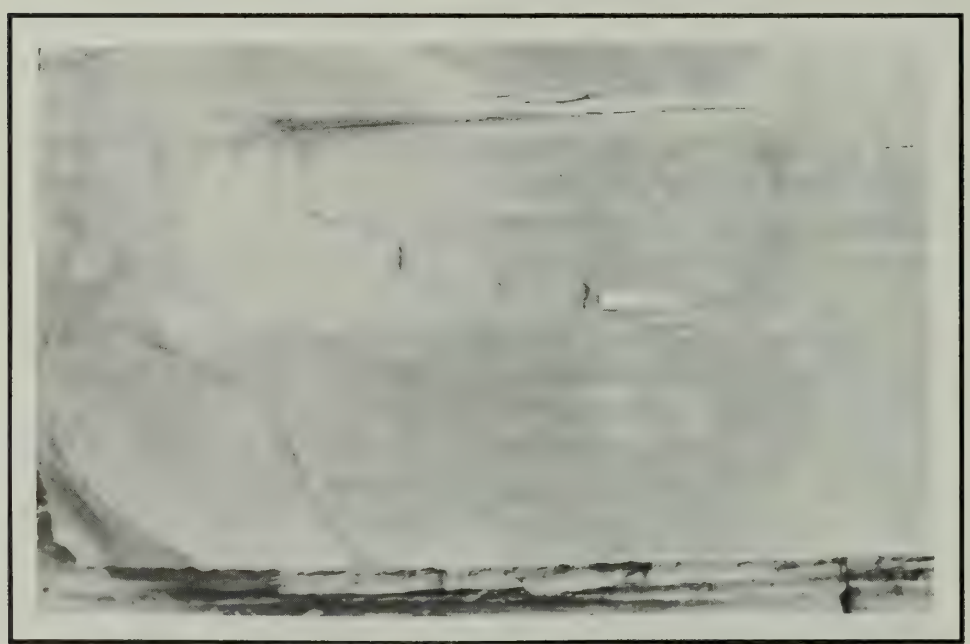


FIGURE 9.23. WS-834, Panel 2. Main element appears to be a textile design (Schaafsma 1987:26).

today (Pilles 1987b:117). A good example of the temporal restrictions of subject matter would be the horse, as we know it was first introduced into the Southwest by the Spanish in the sixteenth century (Schaasfma 1980:15). Thus, any horse depicted in rock art has to be within a historic or modern context.

Several discussions have concerned the meaning of southwestern rock-art features. H.M. Wormington suggests that "some had religious significance, were possible records, were designed to give information, or were done for amusement" (1951:47). Harold S. Colton feels that the rock drawings were made "as 'doodles', as fetishes, and as signatures of travelers" (1946b:8). Christy G. Turner noted three possible meanings within his Glen Canyon rock-art study: (1) petroglyphs were primarily the work of men, who depicted their interests, (2) some were possibly done by childern imitating their elders, and (3) some may represent "art for art's sake" (1963:29). One of the most frequent misconceptions is the idea that rock-art figures are a form of ancient writing (Schaafsma 1980:13). Attempts at "reading" these rock art forms are pure guesswork (Grant 1978: 155).

With these ideas in mind, some interpretation of the rock art at Wupatki can be given. Three cultural styles are present throughout the national monument: Sinagua, Kayenta Anasazi, and Little Colorado Anasazi (for a comparison of some of these elements see Colton 1946b:7, Figure 4). The most common and widespread rock art form found in the Glen Canyon region was defined as "Style 4" (Turner 1963:6). This style is also called the "Kayenta Representational Style," with many elements represented (Schaafsma 1980:143). The style begins between A.D. 900 and 1050 and lasts for nearly 200 years throughout the northern extent of the

FIGURE 9.24. WS-834, Panel 72 - Outlined cross (a Pueblo I pottery design).

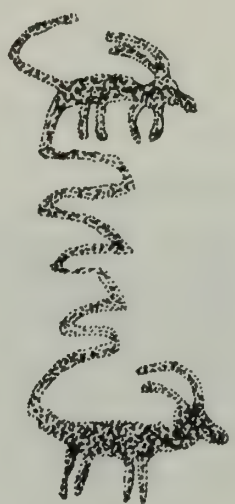


FIGURE 9.25. WS-334, Panel 30 - Joined bighorn sheep.

FIGURE 9.26. WS-2176, Panel A - Stylized bird.

FIGURE 9.27. WS-834, Panel 9 - Stylized lizard.

Anasazi area, and may be traceable to the Hohokam and Mogollon culture areas (Turner 1963:39). Davin and Dolphin also suggest a possible Hohokam origin for petroglyphs found at Inscription Point (1973:8). This style, however, is clearly Anasazi, and is associated with numerous Wupatki sites which have Kayenta and Little Colorado Anasazi ceramics associated with them. In Turner's discussion of the distribution of this style, six sites within the Wupatki area are listed (Turner 1963:34). Certainly, at most of the rock-art sites located within Wupatki National Monument, this is the most common style. Next in the number of elements present is the style found in the upper and middle Little Colorado River drainage and referred to as the "Winslow tradition" (Pilles 1975:2; Schaafsma 1980:155). The style most commonly found at Wupatki is the "Early and Middle Pueblo III Style," of which designs relate to Sosi B/W and Flagstaff B/W ceramic designs (Pilles 1975:8-9). Peter Pilles goes on to say that this style "conforms perfectly with Turner's description of Style 4" (8). Last, in ranking order, are those elements which may be Sinagua in origin. Some of the textile patterns, such as the one located at NA-696, are very typical of Sinagua weaving (Schaafsma 1987:20). I did not locate any designs which I could directly attribute to the Cohonina. There is little doubt, however, that all of these groups were communicating with and influenced by one another (Schaafsma 1980:161).

With the previous discussion in mind, a description of some of the individual elements shown in the plates and along the margins of the text of this chapter can be made. These elements include zoomorphs, anthropomorphs, geometric forms, and specific names and dates. The zoomorphs or animal forms include large game animals

(bighorn sheep, deer, and antelope), snakes, lizards, birds, mountain lions, dogs, coyotes, insects, horses, and other forms. The anthropomorphs, or human forms, include foot and hand prints, kokopellis, "lizard-men," connecting lines, and combined elements that tell a story. Geometric forms include many varying designs, spirals, and enclosed crosses. Finally, several names and dates help to determine the more recent uses of Wupatki.

FIGURE 9.28. WS-155 - Dog or coyote.

ZOOMORPHS

Many of the larger game animals depicted in the rock art of Wupatki may represent a form of hunting magic for animals somewhat hard to obtain, which was not employed for plentiful game (Grant 1967:151-152). These forms also suggest that environment influenced what was depicted; for example, there are

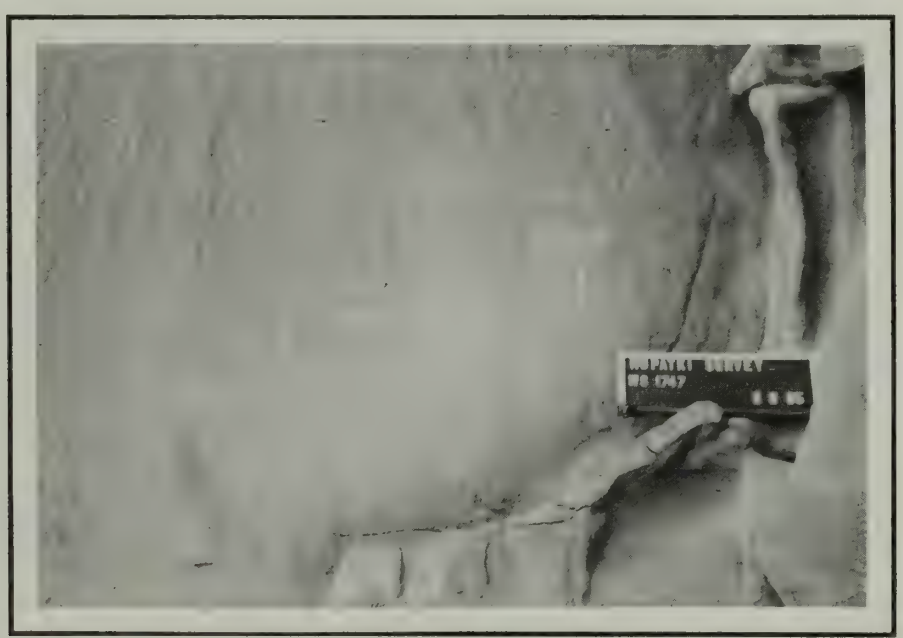


FIGURE 9.29. WS-1747, Panel 2. Pecked bighorn sheep and other elements.

FIGURE 9.30. WS-833, Panel 11 - Two reclining Kokopellis, located near a kiva below Middle Mesa.

numerous mountain sheep shown for the Kayenta Anasazi area, antelope and birds for the Little Colorado Anasazi, and deer for the Sinagua area (Colton 1960:83). In the Kayenta area, bone counts from a number of sites suggest that bighorn sheep were a major food source, and their numerous representations in this region reflects this usage (Schaafsma 1980:48). There are several representations of bighorns at Wupatki (illustrations from WS-81, WS-334, and WS-1747, within this chapter, serve as examples), but bone counts from excavated sites suggest that sheep were not a major food source (see the environmental chapter for a discussion of this factor). Representations of deer from WS-833 (Figure 9.31) and antelope (Figure 9.3) are also found within the rock art sites. Antelope representations are very common in the late Pueblo III period of the Little Colorado drainage area (Pilles 1974:11; Schaafsma 1980:155). While there are

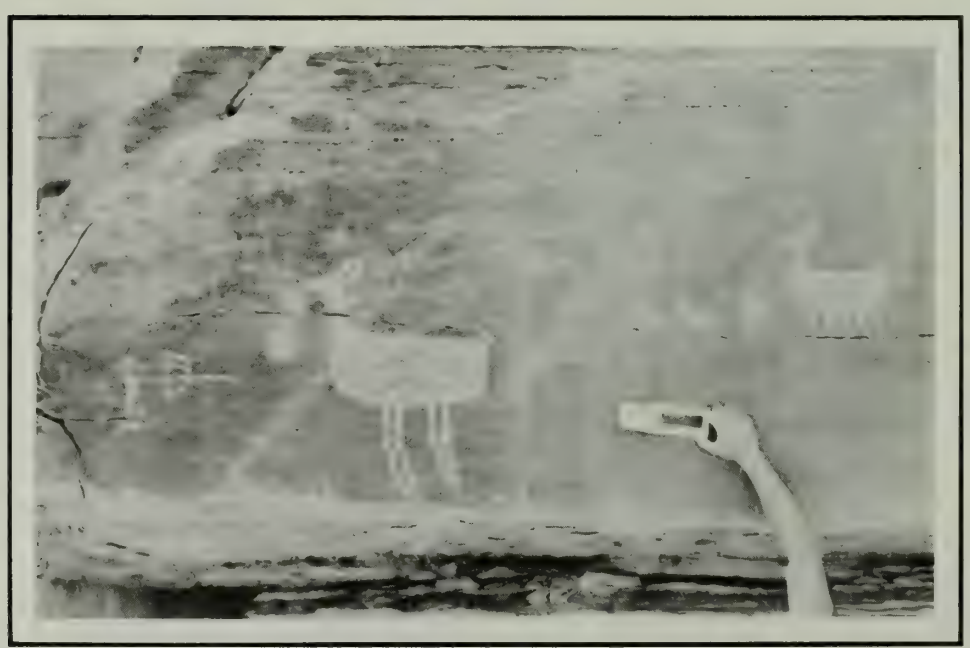


FIGURE 9.31. WS-1747, Panel 2. A classic deer hunting scene.

numerous antelope found on the monument today, however, there are few representations at the rock-art sites that were surveyed. It appears, at least at Wupatki, that some form of supernatural hunting magic is reflected in the rock art.

Snakes and lizards are common locally fauna, and are widely represented at numerous rock art sites. Examples shown within this chapter derive from WS-834, WS-1290, WS-1445, WS-1460, WS-1636, WS-1645, WS-1688, WS-1739, WS-1808, and WS-2056. There are many more examples which are not illustrated in this chapter, but which further indicate that snakes and lizards are the preferred zoomorph at Wupatki National Monument. They are also common within the Kayenta area (Schaafsma 1966:39). Within the Little Colorado area, lizards often have a rectilinear appearance and frequently have bulbous or circular torsos (Schaafsma 1980:155). Figure 9.8 from WS-1290 and Figure 9.27 from WS-834 illustrate these characteristics. Snakes and lizards also appear as anthropomorphs and geometric forms. Often, stick figures with upheld hands are thought of as either lizards or humans, and they are sometimes referred to be rock-art specialists as "lizard-men" (Schaafsma 1966:37, 1980:136). Figure 9.42 from WS-1634 is a good exampleof this. Snakes are also sometimes presented as spirals (Figures 9.32 and 9.39).

Another zoomorph, which has only a limited representation, includes all of the bird forms. The few birds found at Wupatki may have ceremonial implications, in that they may relate to shamanic practices and the properties of magic flight (Schaafsma 1980:133). Ducks are also often associated with shamanism (134). Other birds frequently found in the Kayenta area are geese with teardrop-shaped bodies and long necks, and some turkeys (Schaafsma

FIGURE 9.32. WS-1445, Petroglyph 1-Spiral, which is a coiled snake.

FIGURE 9.33. WS-833, Panel 17 - Dog or coyote

FIGURE 9.34. WS-833, Panel 8 - Mountain lion.

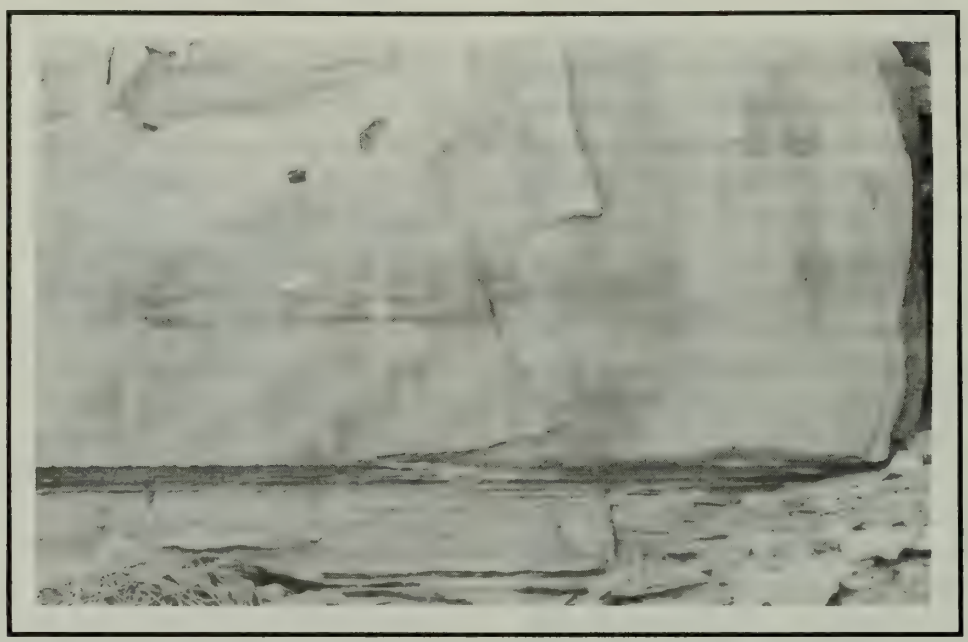


FIGURE 9.35. WS-834, Panel 39. "Fat" Lizards and other elements (Schaafsma 1987:23).

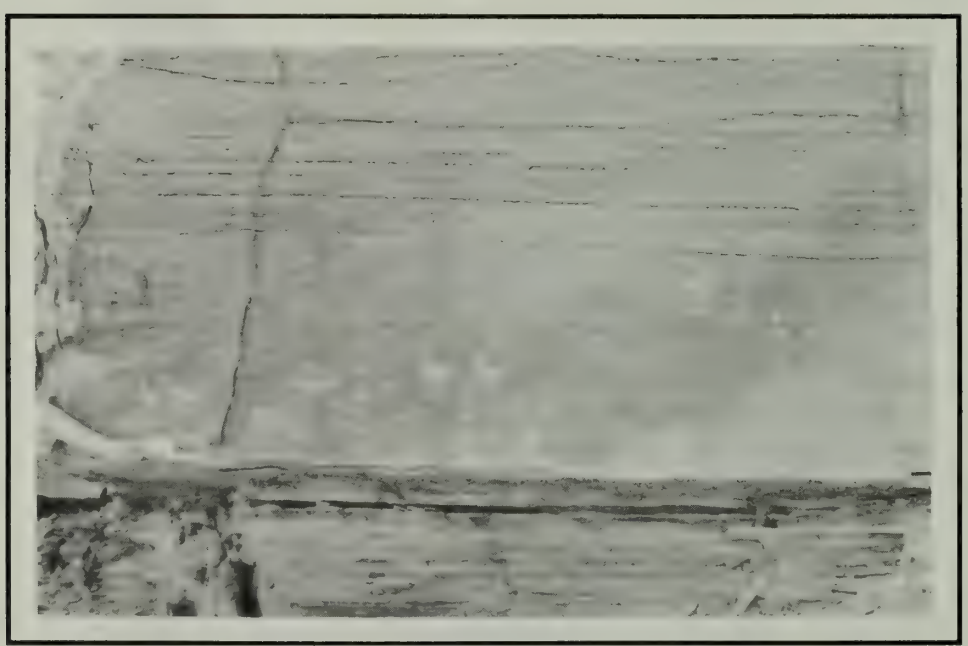


FIGURE 9.36. WS-833, Panel 1. Birds, animals, and line of crosses which may either tracks or insects.

1966:40). An example of this from WS-831 is shown in Figure 9.5. "Thunderbirds," generally represented with their heads to the side and wings outspread, are often used as clan symbols (Grant 1967:58-59). An example of these figures is found at WS-831 (Figure 9.9). One last example, shown in Figure 9.26, is a stylized bird form found at WS-2176.

Another group of zoomorphs, the carnivores, generally represents dogs, coyotes, and mountain lions. Most long-tailed quadrupeds could represent carnivores (Schaafsma 1980:158). At Wupatki, stylized mountain lions are shown by tails that curve over their backs (Schaafsma 1987:22), and Figures 9.9 and 9.34 from WS-831 and WS-833 show two mountain lions. In the Kayenta area, small dog-like figures are found at some late sites (Schaafsma 1966:38). Examples found at WS-155, WS-833, and WS-834 could be either dog or coyote forms.

FIGURE 9.37. WS-833, Panel 18 - "The Fire-breathing Dragon", petroglyph is only slightly patinated and may be modern.

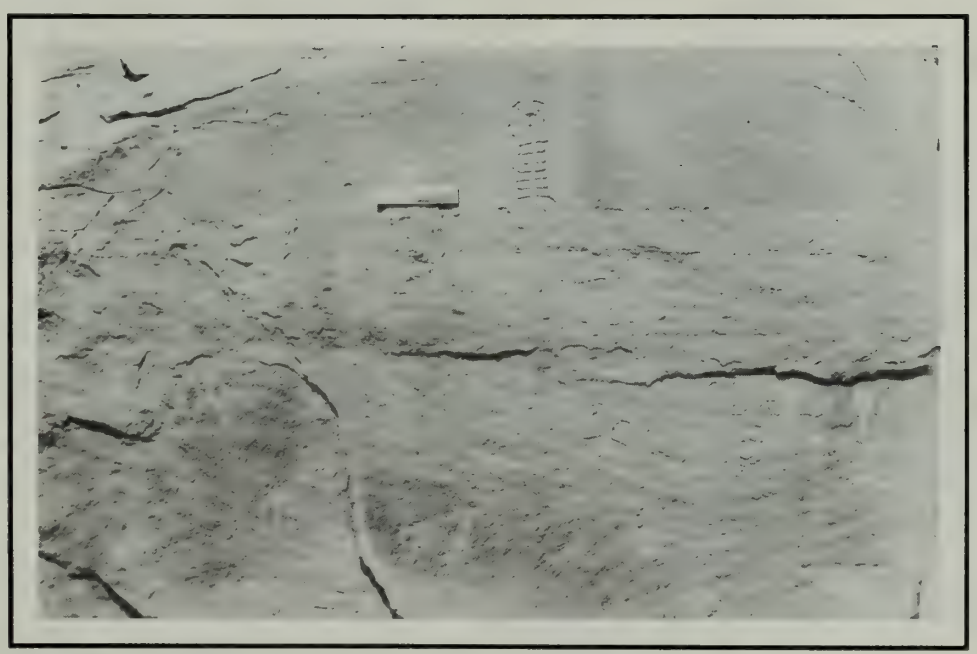


FIGURE 9.38. WS-834, Panel 72. Shows zoomorphs, anthropomorphs, and geometric elements, with a centipede near the top of the photographs.

FIGURE 9.39. WS-1460 - Small spiral snake on a boulder near an enclosure.

Other prehistoric forms include various insects, centipedes, and scorpions generally found in the Little Colorado River drainage (Schaafsma 1980:158). One such centipede, from WS-834, is shown in Figure 9.38. In addition to these various insects there are several other unidentifiable creatures, some of which exceed the naturalistic realm (Schaafsma 1987:22). One such unnatural figure is a fire-breathing dragon found at WS-833 (see Figure 9.40 and Figure 9.37). It is somewhat questionable whether this is a prehistoric figure, as there is not much patination on the pecked surface (which suggests that the element may be modern). Schaafsma does mention a dragon-like figure from the Tsegi Canyon area (1966:39), so the possibility of a prehistoric occurance could exist for Wupatki. This particular feature is one of those questionable occurrences that often appear in rock-art sites, which will probably never be totally explained.

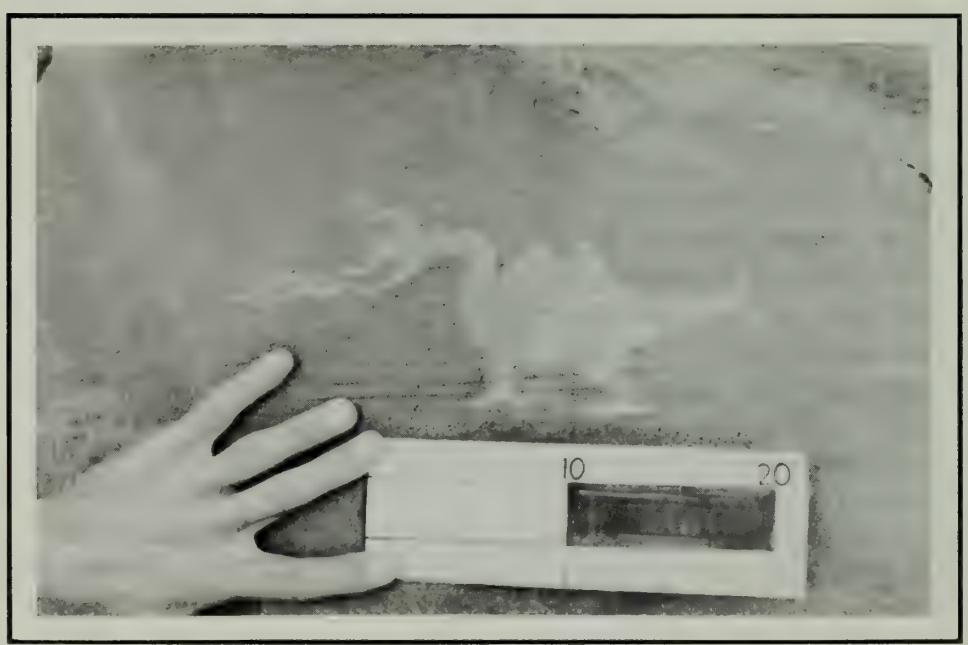


FIGURE 9.40. WS-833, Panel 18. The famous "dragon" of Middle Mesa.

The last of the zoomorphs that I would like to discuss are the horses, which are historic and are found at many Navajo sites. They are also occasionally added to prehistoric panels, as Figure 9.4 illustrates for WS-775. Most of the Navajo rock art showing horses that has been found in New Mexico and Arizona was done over the past two to three hundred years (Schaafsma 1975:4). The earliest examples of horses' bodies in Navajo rock art are generally trapezoidal or rectangular, becoming more curvilinear as the style evolves (Brugge 1981:242). Horses in the Navajo rock drawings often tend to be sleek, with long legs and arched necks, and are somewhat supernatural in character--"beautiful horses--slim like a weasel" (Schaafsma 1980:333). The illustrated example from WS-1770 (Figure 9.14), shows one of these mythical or supernatural horses. An attempt has been made to chronologically order the styles of Navajo horse drawings and three periods (A-C) have been suggested (James and Davidson 1976:27-46). According to James and Davidson, "Style B motifs develop into Style C designs sometime between 1860-1900" (44). These stylistic changes in the horse illustrations are the result of Euro-American influence (Brugge 1976:43). Most of the illustrations of Navajo horses at Wupatki National Monument fall into Style C (see Chapter VI for a discussion of the Navajo occupation of the area). Figure 9.41 from WS-834 shows a more realistic horse drawing (see also Figure 9.44).

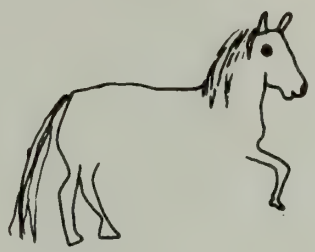


FIGURE 9.41. WS-834, Panel 20 - A Navajo horse scatched into the East face of Horseshoe Mesa.

FIGURE 9.42. WS-1634, Petroglyph 15-An anthropomorph ("lizard-man").

FIGURE 9.43. WS-160, Petroglyph 12 - Realistic human feet.

Anthropomorphs

Anthropomorphic figures have one of the longest periods of representation in the Kayenta area, but there is a trend toward smaller, less massive figures at later sites

FIGURE 9.44. WS-834, Panel 20. Scratched Navajo horse (see Figure 9.26).

FIGURE 9.45. WS-1739, Panel B. A "lizard-man" and possible bear track, with other elements.

(Schaafsma 1966:37). Often these forms can become an abstract expression of natural items, and they are sometimes reduced to a few basic elements such as hands, heads, beaks, or stick figures (Turner 1963:25). Rectilinear stick figures with arms held both up and down, as in Figure 9.51 from WS-160, characteristic are of the late Anasazi tradition (Schaafsma 1980:136). At Wupatki, many of the anthropomorphic elements are somewhat stylized, as can been seen in examples from WS-834, WS-1739, and WS-1763. It is also relevant at this point to discuss hand and footprints and connecting elements. Human footprints and other tracks appear in Pueblo II and Pueblo III contexts in the Kayenta area (Schaafsma 1966:40). Numerous hand and footprints also appear in the Little Colorado area (Schaafsma 1980:158). At Wupatki some large human footprints or bear tracks are

FIGURE 9.46. WS-1645, Panel 2 - A horned toad.

FIGURE 9.47. WS-834, Panel 70 - Dog or coyote.

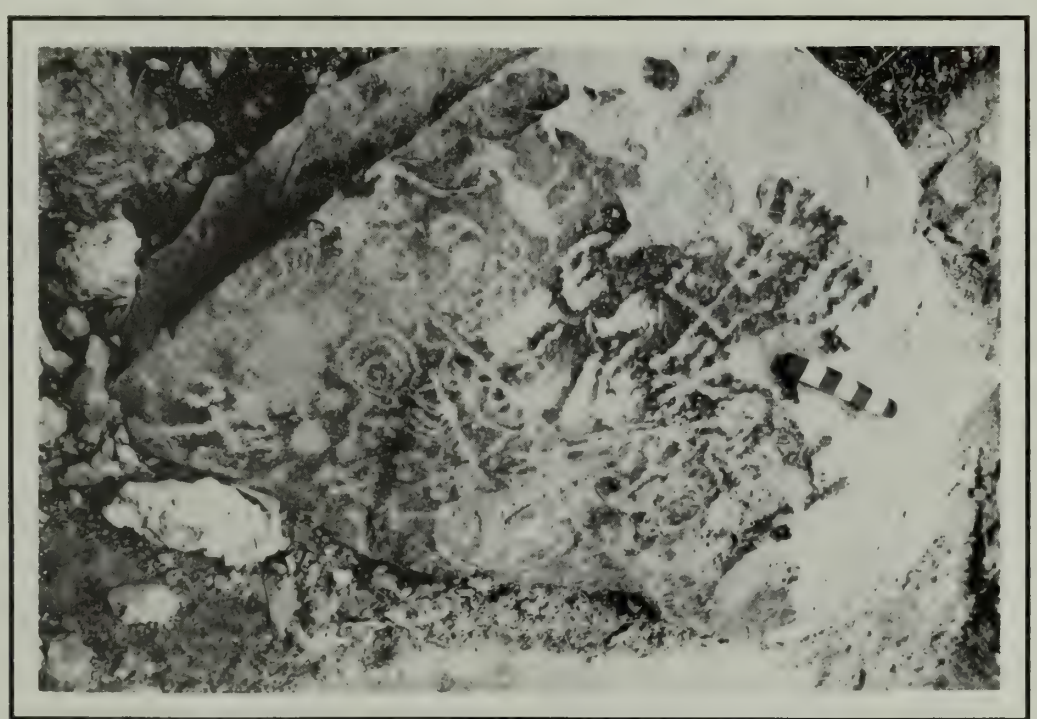


FIGURE 9.48. WS-2039, Panel B. Complex design with connecting elements, but also heavily eroded.

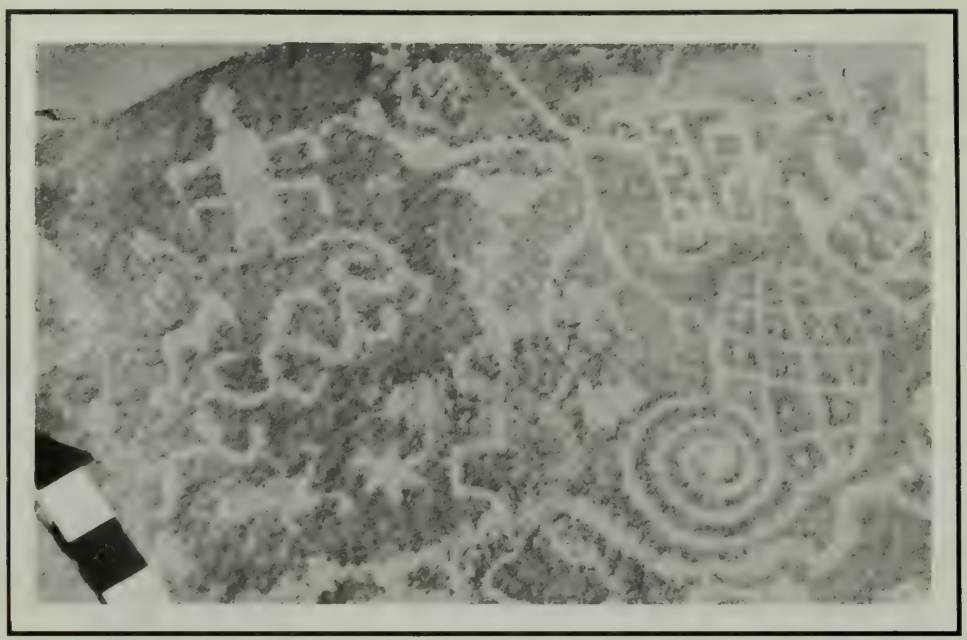


FIGURE 9.49. WS-831, Panel 3A. A closeup view of inter-connected elements.

FIGURE 9.50. WS-834, Panel 41. Anthropomorphs, zoomorphs, and geometric designs on the same panel.

FIGURE 9.51. WS-160, Petroglyph 2 - Possibly an "Earth Mother" representation (a Hopi design).

FIGURE 9.52. WS-660 - Geometric design pecked on a large slab.

also depicted (Schaafsma 1987:22), as in Figure 9.43 from WS-160. Another common feature in the Little Colorado area--the complex and interconnecting figures of many petroglyph panels--may suggest that events from myths are illustrated (Schaafsma 1980:155). These connecting or "power" lines are also found at Canyon de Chelly (Grant 1978:212). Figure 9.25 from WS-334 shows connected bighorn sheep, and Figure 9.49 from WS-831 illustrates the complexity of these designs.

Frequently, within many of the petroglyph panels at Wupatki National Monument, the elements are arranged in such a manner that they appear to represent a story, myth, or ceremony (Colton 1960:83, Davin and Dolphin 1973:4; Schaafsma 1987:24). Examples of such stories are illustrated at WS-831, WS-834, and Inscription Point. It would be useful to collect Hopi-informant information from some of rock-art sites where any possible stories, myths, or ceremonies are represented.

Kokopellis, or hump-back flute players, make their appearance in the Glen Canyon region during the tenth and eleventh centuries A.D. (Turner 1963:25). These mythical beings, which are often associated with late Pueblo III sites in the Kayenta area (Schaafsma 1966:39), are found over a wide area from the Four Corners region into northern Mexico, and appear on Hohokam and Mimbres pottery as well as on rock art (Grant 1967:60). The kokopelli figure is found on contemporary jewelry, ceramics, kachina dolls, textiles, paintings, and rubbings from rock-art sites (Anderson 1976:36). Kokopelli's hump varies in size from quite large to nonexistent, and can resemble a beetle or turtle (Grant 1967:60). Often these figures have an insect-like aspect, are associated with insects, or appear as insects (Schaafsma 1966:39; Anderson 1976:38). They are frequently represented with feathers or horns on their heads, which could also possibly represent insect antennae (Anderson 1976:38). The position of the figures is interesting; in Arizona most are found lying on their backs, while in New Mexico most are upright (Renaud 1948:31). The upright forms often suggest movement such as walking, marching, or dancing (Anderson 1976:36). At Wupatki, most of the kokopellis are reclining, but there are a few upright figures (Figures 9.9, 9.16, and 9.30).

GEOMETRICS

The Little Colorado region is noted for its outstanding abstract rock-art design

which include bold frets, scrolls, and spirals (Schaafsma 1980:155). Within the Kayenta area, concentric circles, spirals, sunbursts, stepped figures, ceramic and textile designs, stepped diamonds, and zigzags make up most of the geometric forms (Schaafsma 1966:40). The great variety of textile and ceramic motifs found in Wupatki's geometric forms is a good source for cross-media studies (Schaafsma 1987:26). The textile and ceramic associations with the rock art suggest that the designs on the walls were done between A.D. 1065 and the early thirteenth century (Schaafsma 1987:25). Interlocking rectilinear scrolls with associated barbed elements resemble ceramic patterns dating from A.D. 1070-1225 (25). Those textile designs which have a central focus are typical Anasazi rock art and cloth, while those which are depicted as an overall limitless pattern, lacking a central motif, are more common to Sinagua weaving patterns (Schaafsma 1987:23-24). Figures 9.53, 9.54, 9.59, and 9.60 (see also Figures 9.55 and 9.58) all illustrate these design elements, and the abstract and geometric designs also occur as kiva paintings (Grant 1978:198).

Other geometric forms include outlined crosses and spirals. The outlined cross is an abstract motif that is sometimes found as a ceramic design (Schaafsma 1987:22). The outlined cross is most prevalent on Pueblo I ceramics from the San Juan region, and the rock art forms are probably the best example of that period's represented cultural remains found at Wupatki, as other Pueblo I cultural components are buried under cinders (Schaafsma 1987:26). Examples of outlined crosses are found at WS-380, WS-834, WS-1071, and Inscription Point (Figure 9.24 and Figure 9.63). Spirals, concentric circles, and watch-spring scrolls are quite

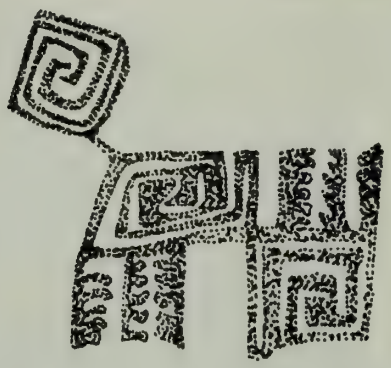


FIGURE 9.53. WS-834, Panel 3 - Geometric design - (Schaafsma 1987:23).

FIGURE 9.54. WS-161, Panel 8 - Open geometric design.

FIGURE 9.55. WS-834, Panel 4. Mostly geometric designs, with a line of anthropomorphs (Schaafsma 1987:26).

FIGURE 9.56. WE-834, Panel 41 - Row of birds and human figures, appear to relate a story.

FIGURE 9.57. WS-1808, Panel 3 - Realistic lizard on east cliff face.

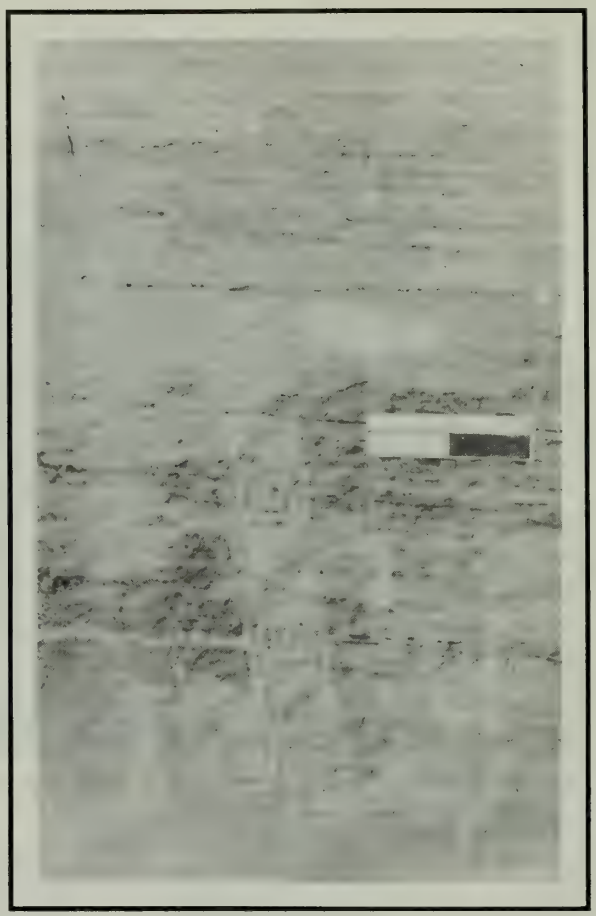


FIGURE 9.58. WS-839, Panel 3. Geometric design, which could also be a ceramic or textile design (see Figure 9.37).

FIGURE 9.59. WS-839, Panel 1 - Geometric ceramic Design (Possibly Sosi Black-on-White or Holbrook Black-on-White).

common in the Kayenta region (Turner 1963:25; Schaafsma 1966:41; Schaafsma 1980:143). Spirals, which are also an important element at Wupatki, could have some association with the sun (Figure 9.64). Modern Hopi and Zuni people feel that the spiral represents migrations, which could apply to WS-834. Here there are four spirals in which figures are shown on extended lines or paths leading to the spirals (Schaafsma 1987:22, 25). Figure 9.61 illustrates one of these spirals.

Elements of historic rock art at Wupatki National Monument chiefly include Navajo illustrations, names, and dates, although some of these names and dates could also relate to early ranching, mining, or visitors into the area. Figures 9.65, 9.66, and 9.67 illustrate names and dates, while Figures 9.68 and 9.69 and Figure 9.13 il-

lustrate Navajo art. The name "C. E. Rubi" and the date "2/28/16" shown in Figure 9.65 from WS-1815 refer to an individual who participated in the 1916 U.S.G.S. land survey of Wupatki National Monument. The many other names that are recorded need to be cross-checked with Navajo geneology (see Chapter 6) and other historic documents from the Flagstaff area.

In conclusion, I would like to suggest some approaches for future research of Wupatki rock art and rock art sites. Goals which remain to be accomplished are:

1. more detailed and scaled drawings and recording of some rock-art sites;
2. ethnographic data from Hopi and Navajo informants and references that incorporate rock art materials; and
3. statistical examination of computerized data from rock art sites and elements. It may be possible to find a graduate student to undertake these tasks through a co-operative study program, or by means of some other mechanism. If this does not happen, it may be possibile to utilize knowledgeable volunteers for recording efforts, as was done at Petrified Forest National Park (Jones 1985:2, 1968:1, 1987:1, 7). The Overview of Petrified Forest offers some suggestions on how to approach the ethnographic aspects of rock art study (Stewart 1980:122-123). And finally, suggestions on how to approach computerizing the 1,838+ individual elements can be found in Robert J. Burton's M.A. thesis from the University of Colorado (1971).

FIGURE 9.60. WS-160, Petroglyph 10 - Geometric textile or ceramic design.

FIGURE 9.61. WE-834, Panel 52 - Spiral with birds, (Colton 1960: 83 ; and Schaafsma 1987:22 , 25).

FIGURE 9.62. WS-1645, Geometric design which may also be a site plan map.

FIGURE 9.63. WS-1071, Panel 5. Enclosed crosses pecked on a limestone slab under a shelter.

FIGURE 9.64. WS-833, Panel 13. The Middle Mesa "sun-spiral".

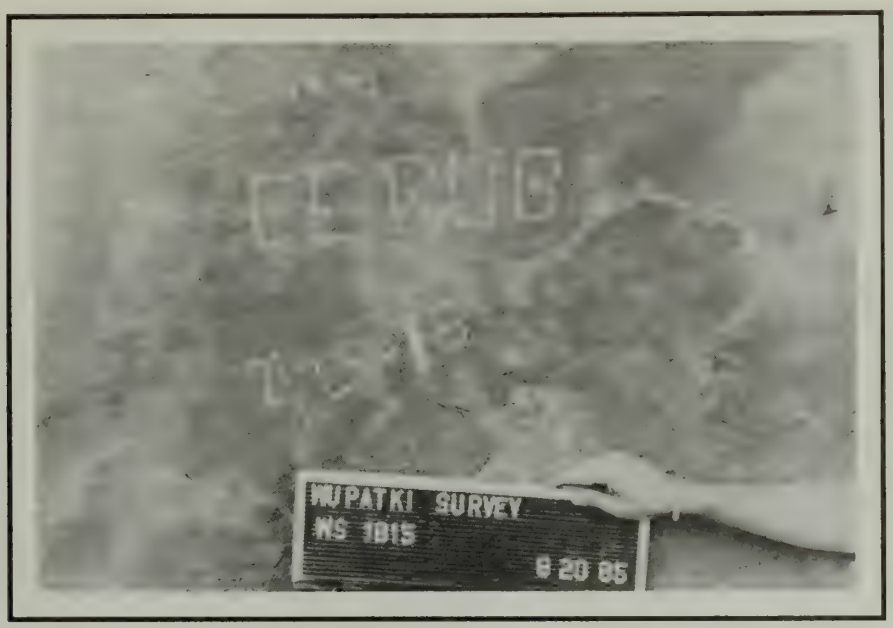


FIGURE 9.65. WS-1815, Panel 4. Name (C.E. Rubi) and date (2/28/16) scratched on a sandstone face.

FIGURE 9.66. WS-2303, Panel 3. While this panel is somewhat eroded, "Juanita Brown" is deeply incised ;The words "Navajo" and "July" can also be observed.

FIGURE 9.67. WS-1660, Panel C. "Coffee-pot" with dates.

FIGURE 9.68. WS-2309, Panel 1. Navajo scratched portrait.

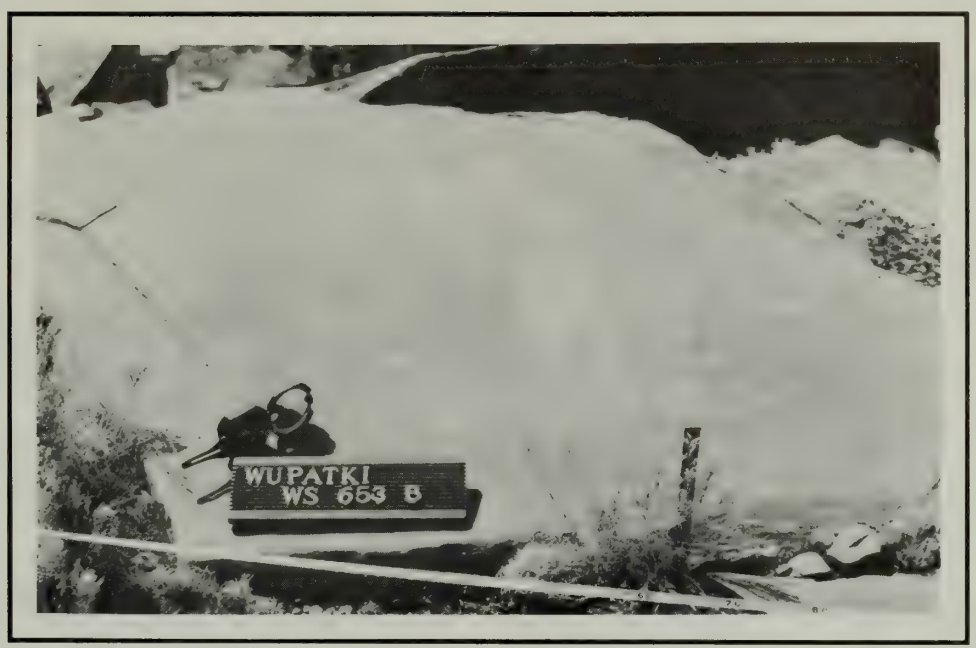


FIGURE 9.69. WS-653, Panel B. Navajo rock art showing a house, truck, airplane, and names.

Chapter 10

Conclusion

By Bruce A. Anderson

The Data Base

A tremendous amount of data was generated from the archeological inventory survey of Wupatki National Monument. None of this could have been accomplished without the dedication of all those who worked on the project, the complete commitment of the National Park Service (Wupatki National Monument staff, Southwest Regional Office staff, and Washington Office staff), and the numerous studies that had been completed prior to the beginning of this survey project (especially through the efforts of the Museum of Northern Arizona and Northern Arizona University). It was never the intent of the inventory survey project to provide the "final" word on the cultural resources of Wupatki National Monument, but rather to completely document and record all of the resources within the boundary and provide the park managers with a mechanism to better protect the archeological sites they managed. What was intended, from the onset of the Wupatki Archeological Inventory Survey Project, was to conduct the research effort in a manner that could provide a maximum amount of information to fulfill several needs. Several thousand survey form pages documenting the 2,668 sites, several hundred maps and photographs, the numerous cultural items collected, and many additional notes, drawings, charts, and graphs are all now available for future research needs. The completed data base was utilized to compile this final report, but it will also serve as an archive for future research. It has also been used to develop a stabilization assessment for the Monument, update the list of classified structures, and provide information for revising the National Register nomination.

Recapping the Volume and the Project

To recapitulate the previous chapters, some additional explanation may be required. There was a concentrated effort to present each chapter on its own merit so that individuals who were interested only in certain sections did not necessarily have to read the complete volume to find what they were looking for. This is not to say that all the chapters do not relate to one another, or that they do not tie together, because they do. Most of the material presented is descriptive and utilizes a narrative approach rather than elaborate statistical formulas. There are a number of tables, which help to categorize certain sets of information, and a number of figures to better illustrate what is being described. The references cited throughout the text provide an excellent reading list, not only for Wupatki prehistory, but also for all of southwestern archeology.

Chapter 1 discussed the background and purpose of the inventory survey project. Included within this discussion are also a description of the project's methodology, and the research questions to be addressed. The survey was designed to utilize a multi-staged approach, which would try to obtain the greatest amount of information with the least amount of resource destruction. Much of the data was collected for the inventory and the resources of Wupatki National Monument, and to learn precisely how many sites existed there. In order to manage and protect those resources, the National Park Service needed to know the exact extent of the archeological sites. Thus, cultural resource management needs formulated the major reasons for the survey project, and the interpretation of the cultures involved was somewhat secondary. Any archeological inquiry, by definition, is also an anthropological inquiry, and this project was no exception to the rule.

Chapter 2 reviewed the site types and cultural perspectives. The purpose of this chapter was to discuss the variability of the numerous cultural sites located during the survey. This chapter also discusses some of the limitations of trying to identify and interpret certain site fucntions from only surface observations. Some of the problems inherent with survey information could be resolved with an excavation program, and additional testing was recommended for approximately 140 sites, or 5%. The remaining sites can now be monitored for vandalism, erosion, site disturbance, and other factors with routine patrols. Recommendations were also made for special mechanisms to better protect these fragile resources. This variability and complexity of the cultural resources is reflected throughout the remaining chapters. A complete listing of all of the sites recorded, WS-1 through WS-2668, is included in Appendix I in the microfiched section in the back of this volume. Additional maps, forms, and records are archived at Wupatki National Monument, the Southwest Regional Office, and the Western Archeological Center of the National Park Service and can be obtained for specific research needs.

The chapter on the environment of Wupatki provides some background on non-archeological factors, which had major influence on the prehistoric and historic activities. These factors are geology, soils, climate, hydrology, flora, and fauna found within the National Monument. Considerable attention is paid to flora and fauna as they reflect the greatest utilization by the previous human occupations (or are more evident than the other factors). More studies are required to understand the relationship and importance of some of these environmental factors. It was sug-

gested that chemical and pH analysis would be useful for known prehistoric field systems. Mapping of the prehistoric reservoirs to better determine volume estimates would help to give an idea of how many people used these water sources. More analysis of excavated faunal materials at Wupatki is required to determine if complete dietary requirements for the prehistoric populations were met. Any new archeological excavations need to be provide maximum environmental information along with cultural research.

Agricultural development is described in Chapter 4, with emphasis on how the prehistoric landscape helped to shape the technology required for crop production. Hierarchical levels of analysis were also utilized to examine agricultural elements and field systems incorporated from the survey data. The prehistoric agricultural landscape of Wupatki National Monument was composed of numerous field systems, comprised of over 12,000 individual elements or features. Eight field element types all described, which were combined in various way to form the seven field system types. Considerable discussion of field structures is also included; they are is but a part of the agricultural strategy utilized prehistorically. Also included are the geographical and environmental factors influencing agricultural behavior. While there were previous discussions on both of these factors in Chapters 2 and 3, this section concentrates on how they relate to agricultural use. What is known is that the agriculture includes a wide range of field sizes, types, configurations, locations, technologies, and spatial associations.

Chapter 5 concentrates on a description and analysis of prehistoric settlement patterns compiled from the survey data. Site functions, estimates of prehistoric population, distribution of populations in a spatial and temporal framework, and considerations of the cultural identity of the prehistoric people living at what is now called Wupatki National Monument from the late A.D. 1000s to approximately A.D. 1225 are addressed. The computerized variables utilized for site-level information are found in Appendix II, in the microfiched section in the back of this volume. The chronological placement of the bulk of the sites was based primarily on ceramics, the best surface indicators available for determining a date of occupation. Because many of the ceramic assemblages were limited at many of the sites recorded, the dating of the occupation of those sites is restricted, or unknown. The ceramics, also excellent indicators of cultural identity for the occupants of the sites recorded, were utilized in cluster analysis for grouping both the ceramic wares and cultural groups. Cluster analyses were also utilized for determining site function by combining the number of structures, masonry rooms, and artifact frequency. This type of attribute analysis is very useful in grouping large quantities of data. Once a chronological scheme was established and a definition of architectural spaces was provided, population estimates could then be formulated. Some research and management recommendations are provided at the end of the chapter. This chapter helped finalize elements discussed in Chapters 2, 3, and 4.

The ethnoarcheology chapter discusses methods and procedures, previous research, changes in Navajo land use, an inventory of the archeological record, and management concerns. The emphasis of this chapter is on ethnography, ethnology, and history as they apply to the historic sites recorded by the archeological inventory survey. Archival research, oral history, onsite interviews, and background research were all utilized is this

chapter. Navajo mobility at Wupatki was determined primarily by available water and limited grazing areas. There were 67 residential Navajo sites located within the boundary of Wupatki National Monument, in addition to a number of temporary camps, sweatlodges, corrals, other livestock facilities, trash dumps, petroglyphs, and other small features. The section on management concerns discusses the numerous religious sites, sacred places, and several burial locations and how these significant sites and areas should be addressed under the Native American Relationships Policy. Suggestions for enhancing the interpretation of Navajo sites and use, the need for a Hopi ethnohistory study, and the importance of an administrative history and continued research at Wupatki National Monument are provided for future park managers. Finally, a partial genealogy is included at the end of the chapter. While there was some discussison of Navajo sites in Chapters 1, 2, and 3, this section emphasizes the presence of the Wupatki Navajo people over the last 120 years and their importance in the cultural landcape of the Monument.

Chapter 7 includes all of the material culture items collected over the seven years of the survey process (excluding the ceramics, which are described in Chapter 8). Included were shell, glass, metal, ground and flaked stone, other items, and lithics. Several tables, illustrations, and photographs help to better describe these items, which are unique to Wupatki history and prehistory. The bulk of this chapter refers to flaked lithic artifacts and the analysis of those materials, which were collected from approximately 400 sites. The chapter concentrates on material types and artifact classes. Analysis of the lithic debitage required a computer program for the 2,339 pieces collected, but a statistical package was not required for the remaining items collected. Because most of the sites where collections were made are represented by a limited number of artifacts on the surface, interpretation also has limited applications. It would be useful to conduct some detailed petrographic and material-specific technological analyses on some of these materials (especially the lithics). To better date the projectile points, more data from excavated, well-dated contexts are required.

Ceramics (approximately 25,000 catalogued sherds) were discussed in Chapter 8. The general assumption of this section is that the changing pottery traditions reflected changing cultural patterns through time. To obtain a more reliable set of statistical data, the ceramics were analyzed for those sites with 100 or more sherds (67 sites, of which 20,506 total sherds were collected). A complete listing of the ceramics, site by site, are shown in Appendix II and discussed in Chapter 5. The sherds from the 67 surveyed sites are compared with 12 excavated sites (which had 56,656 sherds), and the results are shown on Table 8.3 The most impressive ceramics were the three complete vessels and the one restored bowl collected by the survey. The conclusions presented were much the same as those in Chapter 5, but recommendations on additional studies of ceramics were made. More work is needed to determine where the Wupatki ceramics were actually manufactured; trace element and chemical analysis might provide some answers.

Finally, the rock art of Wupatki National Monument is considered in Chapter 9. A total of 132 sites contained rock art, primarily petroglyphs (1,838 elements). Some discussion of previous rock art research is included, although work before the inventory survey is limited and sketchy. Some statements on cultural styles pertaining to

the Kayenta Anasazi, the Little Colorado Anasazi, and Sinagua cultures in the area are added. The major portion of the chapter concentrates on the description of the numerous elements, including zoomorphs, anthropomorphs, geometic forms, and specific names and dates. The zoomorphs (animal forms) included large game animals, mountain lions, dogs, coyotes, horses, snakes, lizards, birds, insects, and other forms. The anthropomorphs (human forms) were also quite varied. The geometric forms included many varying designs, spirals, and enclosed crosses. Several of the names and dates reflect more recent uses at Wupatki. At the end of the chapter, some suggestions for additional research are made.

The reasons for synthesizing the chapters are to better illustrate the many variables discussed, show the differing strategies and approaches to the data, and provide an overview of the major concerns of the project. Three of the authors also worked as crew members on the project (Scott Travis, Alexa Roberts, and Chris Downum). Currently, Scott is completing his M.A. thesis, Alexa is finishing her Ph.D., and Chris just finished his doctoral program, all utilizing information from the Wupatki research. The other three contributing authors have also had longterm interests in Wupatki and the survey project. Lauren Ritterbush, another crew member, wrote her M.A. thesis on Wupatki prehistoric water collection and conservation utilizing survey information. Anne Baldwin and Mike Bremer worked on the project two years and then conducted an inventory survey at Walnut Canyon National Monument. Dr. David A. Breternitz, who graciously consented to be a crew chief for two years, had conducted previous research in the area for the Museum of Northern Arizona. Dr. Michael B. Stanislawski, while not working directly on the survey project, had written his doctoral dissertation on material cultural items from Wupatki Pueblo. The advice, comments, and expertise of all these individuals made this report what it is. If "variety is the spice of life," the variety provided by the resources of Wupatki National Monument and by all individuals who worked on the archeological inventory survey project certainly "spiced" up my life. While some readers may find a few elements not discussed as fully as they would desire, this volume has attempted to show a complete picture of the survey process.

Interpretative Changes

A few interpretative changes, have been made in the prehistory of Wupatki from survey information and recent research. One is the concept of a prehistoric "landrush" into the Wupatki area (Colton 1937), which needs to be modified to reflect other possibilities, such as the use of lower elevations in farming technology (Pilles 1987). Along with this, population estimates need to be adjusted to exclude field structures from permanant habitation sites (Pilles 1978:32). Chapter 5 relects this argument, considerably reducing previous estimates of Wupatki's population. Chapter 4 suggests that the agricultural technology may also have been much more sophisticated than other researchers had observed previously. We know that water resources on Antelope Prairie (the area of the denser site locations) were limited, but the prehistoric occupants were able to adapt to this factor (Ritterbush 1984).

The causes for abandonment of the Wupatki area also need to be reexamined. Two possible scenarios or suggested reasons for abandonment were diseases due to unsanitary conditions and erosion of the cinder

mulch due to wind action and drought (Colton 1936, 1937; Downum 1988:190-200). Chapter 3 discusses these possibilities but does not resolve the causes. It is suggested that through additional studies, such as detailed burial analyses, coprolite studies, and nutritional analyses, some clues about the disease factor could emerge. We know that the climate was drier from A.D. 1150 to abandonment, but this may not have been the only reason people left the area. Other possibilities include a major change in rainfall patterns and the availability of precipitation (Dean 1988). The soils may have become exhausted of their nutrients (Hevly et. al. 1979), and other resources may have also depleted (Cinnamon 1988). The combination of all of these factors may have been overwhelmed the prehistoric inhabitants of Wupatki.

Future Outlook

Throughout the volume are suggestions for additional research, and several of these have already been mentioned in this chapter. Probably the most important of these recommendations is the call for additional excavation of some of the sites listed for archeological testing. To date, a total of only 12 sites have been previously excavated, and most of this work was conducted in the 1930s and 1940s. With the improved methodology and technology of archeological research today, a tremendous amount of information could be acquired from only a few sites. While I strongly adhere to the conservation ethic (Lipe 1974) and the minimal impact ethic (Judge 1979) discussed in Chapter 1, I also know that to obtain answers for the many interpretative questions the survey data presented, additional excavation is required. I also realize that because of evertightening budget constraits, this may be difficult to accomplish immediately, but it should certainly be a priority for the future.

In retrospect, the final accomplishments of the inventory survey project were fairly extensive. Most of the goals discussed in Chapter 1 were achieved, and some additional activities were also added to the fieldwork responsibilities. Additional analysis could have been carried out on the artifacts collected, had there been more time and money available, but in any case, they have been curated for future research. The survey methodology utilized was as complete and through as it could be, given today's technology. While the coverage of the land mass of Wupatki National Monuent is now complete, I am sure that additional sites will be exposed by erosional or ground-disturbing construction activities. The park management can now monitor and better protect these fragile, nonrenewable resources by knowing the location, extent, and condition of the 2,668 sites within the National Monument boundary. They also can now begin to prioritize some of the additional studies and needs required for these archeological sites. The General Management Plan now needs to be updated to reflect this additional bulk of information. The Resources Management Plan also needs to be revised accordingly. The Exhibit Plan can now be finally addressed utilizing this information. Also, a revised Collections Management Plan is required now that all of the survey collections have been catalogued and are in storage.

With all of the work, reports, and data generated by the Wupatki Archeological Inventory Survey Project, we only touched the surface (pun intended). Hopefully this mass of data will be utilized to better set the stage for future studies at Wupatki National Monument. As other researchers review this volume, I hope that they can find addi-

tional mechanisms or provide additional suggestions to help clarify the archeological picture of Wupatki National Monument. A memorandum of agreement has been established with Northern Arizona University to assist students with projects that will address park needs. In future years, Northern Arizona University graduate students may accomplish some of the additional studies suggested in this report. At the very least, this massive effort can serve as a stepping stone or beginning place for archeological inquiry to take place for decades to come.

BIBLIOGRAPHY

Adams, William Y.

1986 Navajo Social Dynamics: Some Unanswered Questions. Paper presented at the first Navajo Studies Conference, Albuquerque.

Ahler, Stanley A.

1977 Functional Analysis of Non-Obsidian Chipped Stone Artifacts: Terms, Variables and Quantification. Paper prepared for the Conference on Lithic Use-Wear, Vancouver, British Columbia, March 16-20, 1977.

Ahlstrom, Richard V. N.

1990 Flagstaff-Area Tree-Ring Dates: A Reassessment. Paper presented at the 55th Annual Meeting of the Society for American Archeaeology, Las Vegas, Nevada.

Allison, Franklin E.

1957 Nitrogen and Soil Fertility. In Soil: The Yearbook of Agriculture. U.S. Department of Agriculture, Washington, D.C.

Anderberg, Michael R.

1973 Cluster Analysis for Applications. Academic Press, New York.

Anderson, Bruce A.

1976 Kokopelli: The Humpbacked Flute Player. American Indian Art, Vol. 1, No. 2, pp. 36-40.

1977 Archaeological Survey of a Proposed Maintenance and Residence Area with Associated Water Lines at Heiser Spring--Wupatki National Monument. Report on file, Southwest Cultural Resources Center, National Park Service, Santa Fe.

1980 Pre-stabilization Archeological Excavations for Heiser Springs Pit Houses (NA 1754), Wupatki National Monument. Report submitted to the National Park Service, Southwest Cultural Resources Center, Santa Fe.

1981 An Archeological Inventory Survey for Wupatki National Monument: Scope of Work and Research Design for Phase I. Report submitted to the National Park Service, Southwest Regional Office, Santa Fe.

1982 An Archeological Inventory Survey for Wupatki National Monument: Preliminary Report for Phase I and Research Design for Phase II. Southwest Cultural Resources Center, National Park Service, Santa Fe.

1983 An Archeological Inventory Survey for Wupatki National Monument: Preliminary Report for Phase II and Research Design for Phase III. Southwest Cultural Resources Center, National Park Service, Santa Fe.

1984 An Archeological Inventory Survey for Wupatki National Monument: Preliminary Report for Phase III and Research Design for Phase IV. Southwest Cultural Resources Center, National Park Service, Santa Fe.

1986 An Archeological Inventory Survey for Wupatki National Monument: Preliminary Report for Phase V and Research Design for Phase VI. Southwest Cultural Resources Center, National Park Service, Santa Fe.

1987 An Archeological Inventory Survey for Wupatki National Monument: Preliminary Report for Phase VI and Research Design for Phase VII. Southwest Cultural Resources Center, National Park Service, Santa Fe.

Anderson, Bruce A., and Peter J. McKenna

1985 An Archeological Inventory Survey for Wupatki National Monument: Preliminary Report for Phase IV and Research Design for Phase V. Southwest Cultural Resources Center, National Park Service, Santa Fe.

Babbitt, James E.

1986 Trading Posts Along the Little Colorado River. Plateau, Vol. 57, No. 3, pp. 2-9.

Babbitt, John G.

1967 The Babbitt Brothers Trading Company. Privately printed, Flagstaff, Arizona.

Babenroth, Donald L., and Arthur N. Strahler

1945 Geomorphology and Structure of the East Kaibab Monocline, Arizona and Utah. Bulletin of the Geological Society of America, Vol. 56, pp. 107-150.

Bailey, Garrick, and Roberta Bailey

1986 A History of the Navajos: The Reservation Years. School of American Research Press, Santa Fe.

Bain, James G.

1970 Rock Art. El Palacio, Vol. 77, No. 1, pp. 1-13.

Baldwin, Anne R., and J. Michael Bremer

1986 Walnut Canyon National Monument: An Archeological Survey. Publications in Anthropology No. 39. U.S. National Park Service, Western Archeological and Conservation Center.

Baldwin, Gordon C.

1940 Prehistoric Southwestern Basketry. The Kiva, Vol. 5, No. 7, pp. 25-28.

Ball, S. H.

1941 The Mining of Gems and Ornamental Stones by American Indians. Bulletin 128, Anthropological Paper Number 13. Bureau of American Ethnology, Washington, D.C.

Barrett, Samuel A.

1927 Reconnaissance of the Citadel Group of Pueblo Ruins in Arizona. Yearbook of the Public Museum of the City of Milwaukee, Vol. 6, pp. 7-58.

Bartlett, Katherine

1930 Stone Artifacts: San Francisco Mountain Region. Museum Notes, Vol. 3, No. 6, pp. 104.

1931 Prehistoric Pueblo Foods. Museum Notes, Vol. 4, No. 4, pp. 1-4

1933 Pueblo Milling Stones of the Flagstaff Region and Their Relation to Others in the Southwest: A Study in Progressive Efficiency. Museum of Northern Arizona, Bulletin No. 3. Flagstaff.

1934 The Material Culture of Pueblo II in the San Francisco Mountains, Arizona. Museum of Northern Arizona, Bulletin No. 7. Flagstaff.

1935 Prehistoric Mining in the Southwest. Museum Notes, Vol. 7, No. 10, pp. 41-44.

1939 A Prehistoric "Mine" of Red Argillite, Resembling Pipestone, near Del Rio, Arizona. Museum Notes, Vol. 11, No. 12, pp. 75-78.

1942 Notes Upon a Primitive Stone Industry of the Little Colorado Valley. Plateau, Vol. 14, No. 3, pp. 37-41.

1943 A Primitive Stone Industry of the Little Colorado Valley, Arizona. American Antiquity, Vol. 8, No. 3, pp. 266-268.

1980 Mostly Pebbles along the Little Colorado. In Camera, Spade and Pen, ed. Marnie Gaede, pp. 90-95. University of Arizona Press, Tucson.

Bassett, Carol Ann

1983 Spring Sheep Drive on Arizona Trails: Taking the High Road in Basque Tradition. American West, Vol. 20, No. 3, pp. 22-28.

Bateman, Gary C.

1980 Natural Resource Survey and Analysis of Sunset Crater and Wupatki National Monuments: Final Report (Phase III). Report prepared for the Office on Natural Resources Management, National Park Service, Southwest Region, by Department of Biological Sciences, Northern Arizona University, Flagstaff.

Bateman, Gary C., Russell P. Balda, Lynn Beatty, and Terry A. Vaughn

1976 Checklists of Amphibians, Reptiles, Birds, and Mammals of Sunset Crater and Wupatki National Monuments. Report prepared for the National Park Service by Department of Biological Sciences, Northern Arizona University, Flagstaff.

Beaglehole, Ernest

1936 Hopi Hunting and Hunting Ritual. Yale University Publications in Anthropology #4. Yale University Press, New Haven.

1937 Notes on Hopi Economic Life. Yale University Publications in Anthropology #15. New Haven, Conn.

Berke, Debra A.

1981 Art for Rock's Sake. Courier, Vol. 4, No. 12, p. 5.

Berlin, G. Lennis, J. Richard Ambler, J. Richard H. Hevly, and Gerald G. Schaber

1977 Identification of a Sinagua Agricultural Field by Aerial Thermography, Soil Chemistry, Pollen/Plant Analysis, and Archaeology. American Antiquity, Vol. 42, No. 4, pp. 588-600.

Bertsch, Hans

1985 Two Northern Periphery Hohokam Petroglyph Sites: Stanton and Lomaki, Arizona. San Diego Museum Papers, No. 18, Vol. 2, pp. 61-64.

Betancourt, Julio L., and Owen K. Davis

1984 Packrat Middens from Canyon de Chelly, Northeastern Arizona: Paleoecological and Archaeological Implication. Quaternary Research, Vol. 21, pp. 56-64.

Betancourt, Julio L., and Thomas R. Van Devender

1981 Holocene Vegetation in Chaco Canyon, New Mexico. Science, Vol. 214, November 6, pp. 656-658.

Binford, Lewis R.

1964 A Consideration of Archeological Research Design. American Antiquity, Vol. 29, p. 425-441.

1978 Nunamuit Ethnoarchaeology. Academic Press, New York.

Binford, Lewis, and George Quimby

1963 Indian Sites and Chipped Stone Materials in the Northern Lake Michigan Area. Fieldiana, Anthropology, No. 12, pp. 277-307.

Birkedal, Ted

1983 Archeological Survey of a Proposed Sewer Lagoon Expansion Tract for the Indian Health Service, East of Kyakotsmovi, Navajo County, Arizona. Report submitted to the National County Service, Southwest Regional Office, Santa Fe.

Birkedal, Ted, Bruce Panowski, and Walter Wait

1982 Archeological Survey of a Proposed Sewer Lagoon and Sewerline Right-of-Way for the Indian Health Service and the First Mesa Improvement Project, West of the First Mesa, Navajo County, Arizona. Report submitted to the National Park Service, Southwest Regional Office, Santa Fe.

Boekelman, Henry J.

1936 Shell Trumpet from Arizona. American Antiquity, Vol. 2, No. 1, pp. 27-31

Bradfield, Maitland

1971 The Changing Pattern of Hopi Agriculture Royal Anthropological Institute of Great Britain and Ireland, Occasional Papers, No. 30. London.

Bradley, Zorro A.

1959 Three Prehistoric Farm Structures at Wupatki National Monument. Plateau, Vol. 32, No. 1, pp. 12-22.

Bradley, Zorro A., and Cecil D. Lewis, Jr.

n.d. A Bird Check List for Wupatki and Sunset Crater National Monuments. Report prepared for the National Park Service, Flagstaff.

Brady, L. F.

1935a Notes on the Geology of Northern Arizona: Number 2, The Moenkopi Sandstone. Museum Notes, Vol. 8, No. 2, pp. 9-12.

1936b Cheirotherium. Southwestern Monuments Monthly Report,September, p. 231.

1939 Tracks in the Coconino Sandstone Compared with Those of Small Living Anthropods. Plateau, Vol. 12, No. 2, pp. 32-34.

Brain, C. K.

1976 Some Principles in the Interpretation of Bone Accumulations Associated with Man. In Human Origins: Louis Leakey and the East African Evidence, ed. G. L. Isaac and E. R. Mc Cown, pp. 97-116. W. A. Benjamin, Menlo Park, California.

Brand, Donald D.

1937 Southwestern Trade in Shell Products. American Antiquity, Vol. 2, No. 4, pp. 300-302.

Breed, Carol S., John F. McCauley, William J. Breed, Camilla K. McCauley, and Augustus S. Cotera, Jr.

1984 Eolian (Wind-formed) Landscapes. In Landscapes of Arizona: The Geological Story, ed. Terah L. Smiley, J. Dale Nations, Troy L. Pe'we', and John P. Schafer, pp. 359-413, University Press of America, Lanham and New York.

Breed, William J.

1969 A Pliocene River Channel in Wupatki National Monument, Arizona. Journal of the Arizona Academy of Science Vol. 5, No. 3, pp. 177-181.

1976 Molten Rock and Trembling Earth: The Story of a Landscape Evolving. Plateau, Vol. 49, No. 2, pp. 2-13.

Bremer, Jon Michael

1988 Settlement and Land Use in the Walnut Creek Drainage of North Central Arizona during the 12th and 13th Centuries. Master's thesis, Department of Anthropology, Northern Arizona University, Flagstaff.

Breternitz, Cory D.

1976 An Analysis of Axes and Mauls from Chaco Canyon, New Mexico. Report prepared for the Chaco Center, Albuquerque, New Mexico.

Breternitz, David A.

1963 The Archaeological Interpretation of Tree-Ring Specimens for Dating Southwestern Ceramic Styles. Ph.D. dissertation, Department of Anthropology, University of Arizona, Tucson.

1966 An Appraisal of Tree-Ring Dated Pottery in the Southwest. Anthropological Papers of the University of Arizona, No. 10. University of Arizona Press, Tucson.

1967 The Eruption(s) of Sunset Crater: Dating Effects. Plateau, Vol. 40, No. 2, pp. 72-76.

Breternitz, David A., P. Hogan, S. James, A. Kane, R. Knudson,T. Kohler, W. Lipe, and L. Sebastian

1979 Dolores Archeological Program Fieldwork Operations, 1978, Research Design. Prepared for the Bureau of Reclamation, Upper Colorado Region, Salt Lake City, Utah.

Brewer, James

1935a Spring Measurement at Wupatki National Monument. Southwest Monuments Monthly Report, August, pp. 105-106.

1935b Wupatki Petroglyphs. Southwest Monuments Supplement, August, pp. 129-132.

1936 Diary of the Navajo Craftsmen Exhibition. Ms. on file, Wupatki National Monument.

Brewer, Sallie Pierce

1937 The Long Walk to Bosque Redondo. Museum Notes, Vol. 9, No. 11. Museum of Northern Arizona, Flagstaff.

n.d. Diary Kept While Living at Wupatki. Ms. on file, Museum of Northern Arizona (MS 113-1, 2), and in the possession of author.

Brugge, David M.

1976 The Horse in Navajo Rock Art. Awanyu, Vol. 4, No. 4, pp. 34-46.

1981 Horses and Horsemen in Early Native American Art. In Collected Papers in Honor of Erik Kellerman Reed, Papers of the Archeological Society of New Mexico, Vol. 6, pp. 237-250.

Brugge, David M., and Raymond Wilson

1976 Canyon de Chelly National Monument, Arizona, Administrative History 14. Government Printing Office, Washington.

Bryant, Keith L., Jr.

1974 History of the Atchison, Topeka and Santa Fe Railway. McMillian. New York.

Bullard, Jean Valens

1958 We Live at Wupatki. Empire Magazine, March 8. Denver Post.

Burton, Robert J.

1971 The Pictographs and Petroglyphs of Dinosaur National Monument. M.A. thesis, Department of Anthropology, University of Colorado, Boulder.

Busch, Jane

1981 An Introduction to the Tin Can. Historical Archaeology, Vol. 15, No. 1, pp. 95-104.

Butzer, Karl. W.

1982 Archaeology as Human Ecology. Cambridge University Press, Cambridge.

Cahn, Edgar S. (editor)

1982 By Executive Order: A Report to the American People on the Navajo-Hopi Land Dispute. Citizens Advocate Center, Washington, D.C.

Carlson, Roy L.

1983 The Far West. In Early Man in the New World, ed. Richard Shutler, Jr., pp. 73-96. Sage Publications, Beverly Hills, California.

Carothers, Steven W., and John R. Haldeman

1967 New Records of Northern Arizona Birds. Plateau, Vol. 40, No. 1, pp. 41-43.

Castetter, Edward F., and Willis H. Bell

1942 Pima and Papago Indian Agriculture. Inter-Americana Series 1. University of New Mexico Press, Albuquerque.

Cave Research Foundation

1976 Wupatki National Monument Earth Cracks. Cave Research Foundation, Yellow Springs, Ohio.

Chisholm, Michael

1979 Rural Settlement and Land Use. Third edition. Hutchinson, London.

Christensen, Paul K.

1982 The Hydrogeology of Sunset Crater and Wupatki National Monuments, Coconino County, Arizona. M.S. thesis, Northern Arizona University.

Chronic, Halka

1983 Roadside Geology of Arizona. Mountain Press Publishing Company, Missoula.

Cinnamon, Steven K.

1984 Spring and Seep Investigation of Wupatki National Monument. Paper prepared for Watershed Hydrology, a course offered at Northern Arizona University, Flagstaff.

1988 The Vegetation Community of Cedar Canyon, Wupatki National Monument as Influenced by Prehistoric and Historic Change. M.S. thesis, Northern Arizona University.

Clarke, David L.

1968 Analytical Archaeology. Columbia University Press, New York.

1977 Spatial Archaeology. Academic Press, London and New York

Cockrum, E. Lendell

1960 The Recent Mammals of Arizona: Their Taxonomy and Distribution. University of Arizona Press, Tucson.

Colbert, Edwin H.

1972 Vertebrates from the Chinle Formation. In Investigation on the Trissic Chinle Formation. Museum of Northern Arizona Bulletin, No. 47. Flagstaff.

1974 Mesozoic Vertebrates of Northern Arizona. In Geology of Northern Arizona, with Notes on Archaeology and Paleoclimate: Part 1, Regional Studies, ed. Thor N. V. Karlstrom, Gordon A. Swann, and Raymond L. Eastwood, pp. 208-219. Geological Society of America.

Collier, John

1940 Correspondence with Dr. H. S. Colton. On file, Museum of Northern Arizona, Flagstaff (MS 162-I-11a).

Colton, Harold S.

1926 The Geographical Distribution of Potsherds in the San Francisco Mountains. International Congress of Americanists, Proceedings of the Twentieth Session, Vol. 2, pp. 119-121.

1932a Sunset Crater: The Effect of a Volcanic Eruption on an Ancient Pueblo People. Geographical Review, Vol. 22, No. 4, pp. 582-590.

1932b A Survey of Prehistoric Sites in the Region of Flagstaff, Arizona. Bureau of American Ethnology Bulletin 104. Washington, D.C.

1934a Archaeological Report on Excavation at Wupatki. Southwestern

Monuments Monthly Report, February, pp. 2-5.

1934b Archaeological Report on Wupatki. Southwestern Monuments Monthly Report, March, pp. 16-19.

1936 The Rise and Fall of the Prehistoric Population of Northern Arizona. Science, Vol. 84, No. 2181, pp. 337-343.

1937 The Eruption of Sunset Crater as an Eye Witness Might Have Observed It. Museum Notes, Vol. 10, No. 4, pp. 9-12.

1938 The Exploration of Limestone Solution Cracks. Museum Notes, Vol. 10, No. 10, pp. 29-32.

1939 Prehistoric Culture Units and Their Relationships in Northern Arizona. Museum of Northern Arizona Bulletin 17, Museum of Northern Arizona, Flagstaff.

1940 Tracing the Lost Mines of the Padres. Plateau, Vol. 13, No. 2, pp. 17-22.

1941 Winona and Ridge Ruin, Part 1: Notes on the Technology and Taxonomy of the Pottery. Museum of Northern Arizona Bulletin 19, Flagstaff.

1945 A Revision of the Date of the Eruption of Sunset Crater. Southwest Journal of Anthropology, Vol. 1, No. 3, pp. 345-355.

1946a The Sinagua: A Summary of the Archeology of the Region of Flagstaff, Arizona. Museum of Northern Arizona Bulletin No. 22, Northern Arizona Society of Science and Art, Flagstaff.

1946b Fools Names Like Fools Faces--. Plateau, Vol. 19, No. 1, pp. 1-8.

1949 The Prehistoric Population of the Flagstaff Area. Plateau, Vol. 22, pp. 21-25.

1955 Pottery Types of the Southwest. Wares 8A, 8B, 9A, 9B: Tusayan Gray, and White Ware, Little Colorado Gray, and White Ware. Museum of Northern Arizona Ceramic Series 3, Museum of Northern Arizona, Flagstaff.

1956 Pottery Types of the Southwest. Wares 5A, 5B, 6A, 7A, 7B, 7C: San Juan Red Ware, Tsegi Orange Ware, Homolovi Orange Ware, Winslow Orange Ware, Awatovi Yellow Ware, Jeddito Yellow Ware, Sichomovi Red Ware. Museum of Northern Arizona Ceramic Series 3C, Museum of Northern Arizona, Flagstaff.

1958a Precipitation about the San Francisco Peaks. Arizona Museum of Northern Arizona Technical Series No. 2, Flagstaff.

1958b Pottery Types of the Southwest. Wares 14, 17, 18: Revised Descriptions, Alameda Brown Ware, Prescott Gray Ware, San Francisco Mountain Gray Ware. Museum of Northern Arizona Ceramic Series 3D, Museum of Northern Arizona, Flagstaff.

1960 Black Sand. University of New Mexico Press, Albuquerque.

1964 Principal Hopi Trails. Plateau, Vol. 36, No. 3, pp. 91-94.

1965 Experiments in Raising Corn in the Sunset Crater Ashfall Area East of Flagstaff, Arizona. Plateau, Vol. 37, No. 3, pp. 77-79.

1966 The Sproul. Plateau, Vol. 38, No. 4, pp. 75.

1967 The Basaltic Cinder Cones and Lava Flows of the San Francisco Mountain Volcanic Field. Revised edition. Museum of Northern Arizona, Flagstaff.

1968 Frontiers of the Sinaqua. In Collected Papers in Honor of Lyndon Lane Hargrave, ed. by Albert H. Schroeder, pp. 9-15. Papers of the Archaeological Society of New Mexico 1. Museum of New Mexico Press, Santa Fe.

1970 The Aboriginal Southwestern Indian Dog. American Antiquity, Vol. 35, No. 2, pp. 153-159.

Colton, Harold S., and Lyndon L. Hargrave

1933 Pueblo II in the San Francisco Mountains, Arizona, and Pueblo II Houses of the San Francisco Mountains, Arizona. Museum of Northern Arizona, Bulletin, No. 4. Flagstaff.

1937 Handbook of Northern Arizona Pottery Wares. Museum of Northern Arizona, Bulletin, No. 11. Flagstaff.

Colton, Mary R. F., and Harold S. Colton

1918 The Little Known Small House Ruins in the Coconino Forest. Memoirs of the American Anthropological Association, Vol. 5, No. 4, pp. 101-126.

1931 Petroglyphs: The Record of a Great Adventure. American Anthropologist, Vol. 30, No. 1, pp. 32-37.

Cordell, Linda S.

1984 Prehistory of the Southwest. Academic Press, New York.

Crabtree, Don E.

1972 An Introduction to Flintworking. Occasional Papers of the Idaho State University Museum, No. 28.

Crown, Patricia L.

1985 Morphology and Function of Hohokam Small Structures. The Kiva, Vol. 50, No. 2, 3, pp. 75-94.

1987 Water Storage in the Prehistoric Southwest. The Kiva, Vol. 52, No. 3, pp. 209-228.

Cushing, Frank H.

1920 Zuni Breadstuff. Indian Notes and Monographs 8. Museum of the American Indian, Heye Foundation. New York.

Cutler, Hugh C., and Thomas W. Whitaker

1961 History and Distribution of the Cultivated Cucurbits in Americas.

American Antiquity, Vol. 26, No. 4, pp. 469-485.

Daly, Patricia

1969 Approaches to Faunal Analysis in Archaeology. American Antiquity, Vol. 34, No. 2, pp. 146-153.

Danson, Edward

1970 Funeral of Clyde Peshlakai. Ms. on file, Museum of Northern Arizona, Flagstaff.

Davin, Eric, and Gabrielle Dolphin

1973 Petroglyphs of Wupatki. Southwestern Lore, Vol. 39, No. 1, pp. 1-8.

Dean, Jeffrey S.

1988 Dendrochronology and Paleoenvironmental Reconstruction on the Colorado Plateaus. In The Anasazi in a Changing Environment, Ed. by George Gumerman. Cambridge University Press, Cambridge.

Dean, Jeffrey S., Robert C. Euler, George J. Gumerman, Fred Plog,Richard H. Hevly, and Thor N. V. Karlstrom

1985 Human Behavior, Demography, and Paleoenvironment on the Colorado Plateaus. American Antiquity, Vol. 50, No. 3,pp. 537-554.

Dean, Jeffery S., and William J. Robinson

1977 Dendroclimatic Variability in the American Southwest, A.D. 680 to 1970. Final report to the National Park Service, Department of Interior, Southwest Paleoclimate Project, Contract CX-1595-5-0241. Laboratory of Tree-Ring Research, University of Arizona, Tucson.

Dean, L. A.

1957 Plant Nutrition and Soil Fertility. In Soil: The Yearbook of Agriculture, 1957, pp. 80-85. The U.S. Department of Agriculture, Washington, D.C.

De Laguna, Frederica

1942 The Bryn Mawr Dig at Cinder Park, Arizona. Plateau, Vol. 14, No. 4, pp. 53-56.

Denetsosie, Hoke

1977 Stories of Traditional Life and Culture. Navajo Community College Press, Tsaile, Arizona.

DiPeso, Charles C., John B. Rinaldo, and Gloria J. Fenner

1974 The Casas Grandes Shell Report. In Casas Grandes, A Fallen Trading Center of the Gran Chichimeca, Vol. 6, The Amerind Foundation, Dragoon and Northland Press, Flagstaff.

DNA

n.d. Legal records. On file, Law offices of Dinebeiina Nahiilna Be Agagditahe, Tuba City, Arizona.

Dodge, Natt M.

1940 Davey Jones Desert Locker. Arizona Highways, September.

Donaldson, Thomas

1893 Moqui Pueblo Indians of Arizona and Pueblo Indians of New Mexico. U.S. Census Office, Washington, D.C.

Doolittle, William E.

1984 Agricultural Change as an Incremental Process. Annals of the Association of American Geographers, Vol. 74, No. 1, pp. 124-137.

1985 The Use of Check Dams for Protecting Downstream Agricultural Lands in the Prehistoric Southwest: A Contextual Analysis. Journal of Anthropological Research, Vol. 41, No. 3, pp. 279-305.

Douglas, Frederic H.

1931 American Indian Tobacco: Varieties, Cultivation, and Methods of Use. Denver Art Museum, Leaflet No. 22.

Douglass, Andrew Ellicott

1929 The Secret of the Southwest Solved by Talkative Tree Rings.

Douglass, A. E., and Owen Lindauer

1988 Hierarchical and Nonhierarchical Approaches to Ceramic Design Analysis: A Response to Jernigan. American Antiquity, Vol. 53, No. 3, pp. 620-626.

Downum, Christian E.

1988 "One Grand History": A Critical Review of Flagstaff Archaeology, 1851 to 1988. Ph.D. dissertation, University of Arizona.

Downum, C. E., and A. P. Sullivan III

1988 Description and Analysis of Prehistoric Settlement Patterns at Wupatki National Monument. Draft final report to the U.S. National Park Service, Southwest Cultural Resources Center, Santa Fe.

Eddy, Frank W.

1964 Metates and Manos: The Basic Corn Grinding Tools of the Southwest. Museum of New Mexico Press, Popular Series No. 1.

1973 Pueblo Settlement Adaptations in the Upper San Juan Basin of New Mexico and Colorado, A.D. 1125. M.S. thesis, University of Colorado, Boulder.

Ellen, Roy

1982 Environment, Subsistence, and Settlement: The Ecology of Small-scale Social Formations. Cambridge University Press, Cambridge.

Ellis, Florence Hawley

1966 Pueblo Boundaries and their Markers. Plateau, Vol. 38, No. 4, pp. 97-106.

1974 An Anthropological Study of the Navajo Indians. In Navajo Indians I, ed. David A. Horr. Garland, New York.

Emslie, Steven D.

1978 Dog Burials From Mancos Canyon, Colorado. The Kiva, Vol. 43, Nos. 3-4, pp. 167-182.

1981 Birds and Prehistoric Agriculture: The New Mexican Pueblos. Human Ecology, Vol. 9, No. 3, pp. 305-329.

1983 Cultural and Climatic Implications in Anasazi Faunal Exploitation: A Review and Perspectives. In Proceedings of the Anasazi Symposium, 1981, comp. and ed. by Jack E. Smith, pp. 119-123.

Euler, Robert C.

1949 An Economic Study of the Navajos in Wupatki Basin, Arizona. Ms. on file, Wupatki National Monument. Master's thesis, University of New Mexico, Albuquerque.

1953 An Unusual Masonry Wall in a Kayenta Anasazi Cliff Site. American Antiquity, Vol. 19, pp. 393-394.

Euler, Robert C., George J. Gumerman, Thor N. V. Karlstrom,Jeffrey S. Dean, and Richard H. Hevly

1979 The Colorado Plateaus: Cultural Dynamics and Paleoenvironment. Science, Vol. 205, No. 4411, pp. 1089-1101.

Euler, Robert C., and Henry F. Dobyns

1972 The Navajo Indians. Indian Tribal Series, Pheonix.

Ezell, Paul

1937 Shell Work of the Prehistoric Southwest. The Kiva, Vol. 3, No. 3, pp. 9-12.

Fenner, Gloria J.

1986 Shell Artifacts. In The Archeology of Gila Cliff Dwellings. Western Archeological and Conservation Center Publications in Anthropology 36, pp. 175-181. Tucson.

Fewkes, Jesse Walter

1900 Pueblo Ruins near Flagstaff, Arizona: A Preliminary Notice. American Anthropologist, Vol. 2, pp. 422-450.

1904a A Cluster of Ruins Which Should Be Preserved. Records of the Past, Vol. 3, pp. 2-19.

1904b Two Summers' Work in Pueblo Ruins. Twenty-second Annual Report of the Bureau of American Ethnology, Part I.

Fike, Richard E.

1987 The Bottle Book: A Comprehensive Guide to Historic ,Embossed Medicine Bottles. Gibbs M. Smith, Salt Lake City.

Ford, Richard I.

1979 Paleoethnobotony American Archaeology. In Advances in Archaeological Method and Theory, Vol. 2, Ed. by M. Schiffer, pp. 285-336. Academic Press, New York.

1981 Gardening and Farming before A.D. 1000: Patterns of Prehistoric Cultivation North of Mexico. Journal of Ethnobiology, Vol. 1, No. 1, pp. 6-27.

1984 Ecological Consequences of Early Agriculture in the Southwest. Papers on the Archaeology of Black Mesa, Arizona, Vol. II, Ed. Stephen Plog and Shirley Powell, pp. 127-138. Southern Illinois University Press, pp. 127-138, Carbondale.

Forde, C. Daryll

1931 Hopi Agriculture and Land Ownership. Journal of the Royal Anthropological Institute, Vol. 61, pp. 357-405.

1949 Habitat, Economy and Society. E.P. Dutton & Company, New York.

Frison, George C.

1971 Shoshonean Antelope Procurement in the Upper Green River Basin, Wyoming. Plains Anthropologist, Vol. 16. No. 54, pp. 258-267.

1978 Prehistoric Hunters of the High Plains. Academic Press, New York.

Fritts, Harold C.

1965 Tree-Ring Evidence for Climatic Changes in Western North America. Monthly Weather Review, Vol. 93, No. 7, Washington, D.C., pp. 421-443.

Fryer, E. R.

1942 Navajo Social Organization and Land Use Adjustment. Scientific Monthly, Vol. 55, pp. 408-422.

Fuller, Wallace H.

1975 Soils of the Desert Southwest. University of Arizona Press, Tucson.

Gasser, Robert E.

1979 The Experimental Garden At Wupatki (1979). MS submitted to Wupatki National Monument.

1982a Pueblo Plant Foods, Pacific Discovery, Vol. 35, No. 1, January/February, pp. 23-31.

1982b Anasazi Diet. In The Specialists' Volume: BioculturalAnalysis, the Coronado Project Archaeological Investigations, comp. Robert E. Gasser. Museum of Northern Arizona Research Paper 23. Flagstaff.

Gibbon, Guy

1984 Anthropological Archaeology. Columbia University Press, New York.

Gifford, J. C., and Watson Smith

1978 Gray Corrugated Pottery from Awatovi and Other Jeddito Sites in Northeastern Arizona. Papers of the Peabody Museum of Archaeology and Ethnology, Vol. 69. Harvard University Press, Cambridge.

Glassow, Michael A.

1980 Prehistoric Agricultural Development in the Northern Southwest: A Study in Changing Patterns of Land Use. Ballena Press Anthropological Papers No. 16. Socorro, New Mexico.

Grant, Cambell

1967 Rock Art of the American Indian. Thomas Y. Crowell, New York.

1978 Canyon de Chelly: Its People and Rock Art. University of Arizona Press, Tucson.

Green, Christine R., and William D. Sellers

1964 Arizona Climate. University of Arizona Press, Tucson.

Green, L. T., III, and James M. Rominger

1976 Plant Communities of Sunset Crater and Wupatki National Monuments. In Natural Resource Survey and Analysis of Sunset Crater and Wuaptki National Monuments, Final Report, prepared for the National Park Service by the Department of Biological Sciences, Northern Arizona University, Flagstaff.

Greever, William S.

1954 Arid Domain: The Santa Fe Railway and Its Western Land Grant. Stanford University Press, Stanford.

Gregor, Howard F.

1970 Geography of Agriculture: Themes in Research. Foundations of Economic Geography Series. Prentice-Hall, Englewood Cliffs, New Jersey.

Guernsey, Samuel J., and Alfred V. Kidder

1921 Basket-maker Caves of Northeastern Arizona. Peabody Museum Papers, Vol. 13, No. 2, Harvard University, Cambridge.

Gumerman, George J., and S. Alan Skinner

1968 A Synthesis of the Prehistory of the Central Little Colorado Valley, Arizona. American Antiquity, Vol. 33, No. 2, pp. 185-199.

Hack, John T.

1942 The Changing Physical Environment of the Hopi Indians of Arizona. Reports of the Awatovi Expedition 1. Papers of the Peabody Museum of American Archaeology and Ethnology, Vol. 35, No. 2. Cambridge, Massachusetts.

Hackett, Coytt

1979 Historical Atlas for Wupatki National Monument. Ms. on file, Wupatki National Monument.

Hagg, William G.

1966 Dogs from Tse-ta'a. In Excavations at Tse-ta'a, Appendix 2. Archeological Research Series No. 9, U.S. Department of the Interior, National Park Service.

Hardesty, Donald L.

1977 Ecological Anthropology. John Wiley and Sons, New York.

Hargrave, Lyndon L.

1933a Bird Life of the San Francisco Mountains, Arizona, No. 1. Museum Notes, Vol. 5, No. 10, pp. 57-60.

1933b Bird Life of the San Francisco Mountains, Arizona, No. 2, Museum Notes, Vol. 6, No. 6, pp. 27-34.

1933c Pueblo II Houses of the San Francisco Mountains, Arizona. Museum of Northern Arizona Bulletin, No. 4. Northern Arizona Society of Science and Art, Flagstaff.

1933d Archaeological Report on Excavation at Wupatki. Southwestern Monuments Monthly Report, October, pp. 19-21.

1959 Letter to Dr. E. B. Danson, director of the Museum of Northern Arizona, on the bird bones from Wupatki Pueblo.

1965 Turkey Bones from Wetherill Mesa. In Contributions of the Wetherill Mesa Archaeological Project, assembled by Douglas Osbourn. Society for American Archaeology, Memoir 19.

1970 Mexican Macaws: Comparative Osteology and Survey of Remains from the Southwest. University of Arizona Anthropological Papers No. 20. Tucson.

Harrington, H. D.

1972 Western Edible Wild Plants. University of New Mexico Press, Albuquerque.

Hartman, Dana

1973 Final Report for Human Burial Salvage, Prehistoric Site NA12, 512, Arizona. Ms. on file at Museum of Northern Arizona.

Hartman, Dana, and Arthur H. Wolf

1977 Archeological Assessment of Wupatki National Monument. Department of Anthropology, Museum of Northern Arizona, Flagstaff.

Haury, Emil W.

1956 Speculations on Prehistoric Settlement Patterns in the Southwest. Prehistoric Settlement Patterns in the New World, ed. Gordon R. Willey. Viking Fund Publications in Anthropology 23. New York.

1975 The Stratigraphy and Archaeology of Ventana Cave. University of Arizona Press, Tucson.

1976 The Hohokam: Desert Farmers and Craftsmen. The University of Arizona Press, Tucson.

Hayden, Brian (editor)

1979 Lithic Use-Wear Analysis. Academic Press, New York.

Hayes, Alden C.

1964 The Archeological Survey of Wetherill Mesa, Mesa Verde National Park, Colorado. U.S. National Park Service Archeological Research Series 7A. Washington, D.C.

Hayes, Alden C., David M. Brugge, and W. James Judge

1980 Archeological Surveys of Chaco Canyon, New Mexico. Draft version, National Park Service, Washington, D.C.

Hereford, Richard

1984 Climate and Ephemeral-stream Processes: Twentieth-century Geomorphology, and Alluvial Stratigraphy of the Little Colorado River, Arizona. Geological Society of America Bulletin, Vol. 95, pp. 654-668.

Hevly, Richard H., Roger E. Kelly, Glenn A. Anderson, andStanley J. Olsen

1979 Comparative Effects of Climatic Change, Cultural Impact, and Volcanism in the Paleoecology of Flagstaff, Arizona, A.D. 900-1300. In Volcanic Activity and Human Ecology, ed. by Payson D. Sheets and Donald K. Grayson, pp. 487-523. Academic Press, New York.

Hodder, Ian, and Clive Orton

1976 Spatial Analysis in Archaeology. Cambridge University Press, Cambridge.

Hodges, Carroll A.

1962 Comparative Study of S.P. and Sunset Craters and Associated Lava Flows. Plateau, Vol. 35, No. 1, pp. 15-35.

Hoffmeister, Donald F.

1966 Records of Northern Arizona Mammals. Plateau, Vol. 39, No. 2, pp. 90-93.

Hoffmeister, Donald F. and Steven W. Carothers

1969 Mammals of Flagstaff, Arizona. Plateau, Vol. 41, No. 4, pp. 184-188.

Holm, Richard F. and Richard B. Moore

1987 Holocene Scoria Cone and Lava Flows at Sunset Crater, Northern Arizona. In Geological Society of American Centennial Field Guide-Rocky Mountain Section, 1987, pp. 393-397.

Holmer, Richard N.

1978 A Mathematical Typology for Archaic Projectile Points of the Eastern Great Basin. Ph.D. dissertation, University of Utah, Salt Lake City.

1980 Projectile Points. In Sudden Shelter. University of Utah Anthropological Papers No. 103.

Hoover, J. W.

1931 Navajo Nomadism. Geographical Review, Vol. 21, No. 3, pp. 429-445.

Howk, Neil J.

1982 Birds of Wupatki National Monument. Checklist provided to the National Park Service.

Humphrey, Robert R.

1977 Arizona Range Grasses: Their Description, Forage Value, and Management. University of Arizona Press, Tucson.

Indian Claims Commission

1962 Plaintiffs Exhibit 520-P, Dockett 229. Site Reports and Photographs, Vol. 16. Ms. on file, Laboratory of Anthropology, Santa Fe, New Mexico.

Jack, Robert N.

1971 The Source of Obsidian Artifacts in Northern Arizona. Plateau, Vol. 43, No. 3, pp. 103-114.

James, Charles D., III, and Howard M. Davidson

1976 Style Changes of the Horse Motif in Navajo Rock Art: A Preliminary Analysis. American Indian Rock Art, Vol. II, pp. 26-46.

Jameson, Donald A.

1969 Rainfall Patterns on Vegetation Zones in Northern Arizona. Plateau, Vol. 41, No.3, pp. 105-111.

Jernigan, E. Wesley

1978 Jewelry of the Prehistoric Southwest. School of American Research and University of New Mexico Press, Santa Fe and Albuquerque.

1986 A Nonhierarchical Approach to Ceramic Decoration Analysis: A Southwestern Example. American Antiquity, Vol. 51, pp. 3-20.

Jett, Stephen C.

1978 Navajo Seasonal Migration Patterns. The Kiva, Vol. 44, pp. 65-75.

Jochim, Michael A.

1979 Breaking Down the System. Recent Ecological Approaches in Archaeology. In Advances in Archaeological Method and Theory, Vol. 2. Academic Press, New York.

1981 Strategies for Survival: Cultural Behavior in an Ecological Context. Academic Press, New York.

Johnston, Bernice

1940 Correspondence with D. Harold S. Colton. Ms. on file, Museum of Northern Arizona, Flagstaff.

1972 Two Ways in the Desert. Socio-Technical Publications, Pasedena, California.

Johnston, Phillip

1936 The Story of Tolchaco: A Mission for the Navajos 1900-1918. Museum Notes, Vol. 9, No. 2, pp. 9-12.

1939 Peshlakai Atsidi. Plateau, Vol. 12, No. 2.

1942 The Battle at Canyon Padre from the Navajos Point of View. Plateau, Vol. 14, No. 4.

1944 Correspondence to Dr. Watson Smith. On file, Museum of Northern Arizona, Flagstaff.

Johnston, W. R. (editor)

1903-1912 A Neglected People. On file, Museum of Northern Arizona, Flagstaff.

Jones, A. Trinkle

1985 Letter of Appreciation to the American Rock Art Research Association. La Pintura, Vol. 12, No. 2, p. 4.

1986 Letter of Appreciation to the American Rock Art Research Association. La Pintura, Vol. 13, No. 1, 2, p. 1.

1987 Letter of Appreciation to the American Rock Art Research Association. La Pintura, Vol. 14, No. 1, p. 1 and 7.

Jones, Courtney

1940 A Navajo Weaver in Her Home. Pow-Wow Program, Flagstaff.

n.d. Correspondence, articles, journals, on file, Museum of Northern Arizona, Flagstaff.

Jones, David J.

1945

Red Ruins in the Black Cinders: The Story of Wupatki National Monument. Arizona's National Monuments. Southwestern Monuments Association Popular Series No. 2. Santa Fe, New Mexico.

Jones, Volney H.

1936 A Summary of Data on Aboriginal Cotton in the Southwest. Symposium on Prehistoric Agriculture. University of New Mexico Bulletin, No. 296, pp. 51-64.

1941 The Plant Materials from Winona and Ridge Ruin. Appendix 2 in Winona and Ridge Ruin, part I, Museum of Northern Arizona Bulletin, No. 18, pp. 295-300.

1949 Report of Vegetal Material. Appendix 2 in Nalakihu; Excavations at a Pueblo III Site on Wupatki National Monument, Arizona. Museum of Northern Arizona Bulletin, No. 23, pp. 152-157.

Judd, Neil M.

1954 The Material Culture of Pueblo Bonito. Smithsonian Institution, Washington, D.C.

Judge, W. James

1975 Chaco Center: Research Design-Working Draft. Report submitted to the National Park Service, Southwest Regional Office, Santa Fe, New Mexico.

1979 Minimal Impact Archeology: A Plea for a Formalized Ethic. In 1979 Proceedings for the American Society for Conservation Archeology, pp. 1-9.

Judge, W. James, James Ebert, and Robert Hitchcock

1975 Sampling in Regional Archeological Survey. In Sampling in Archeology, ed. W. Mueller, pp. 82-123. University of Arizona Press, Tucson.

Kaplan, Lawrence

1965 Beans of Wetherill Mesa. In Contributions of the Wetherill Mesa Archaeological Project, assembled by Douglas Osbourn, pp. 153-155. Society for American Archeology, Memoir 19.

Karmon, Yehuda

1966 A Geography of Settlement in Eastern Nigeria. Studies in Geography,

pamphlet No. 2. Hebrew University, Jerusalem.

Kearney, Thomas H., and Robert H. Peebles

1951 Arizona Flora. University of California Press, Berkeley and Los Angeles.

Keller, Donald R.

1984 Gray Mountain: A Prehistoric Chert Source Site in Coconino County, Arizona. Arizona Archaeologist No. 19. Arizona Archaeological Society, Phoenix.

Kelley, Klara B.

1986 Navajo Land Use: An Ethnoarchaeological Study, Academic Press, Orlando, Florida.

Kelly, Vincent C., and N. James Clinton

1960 Fracture Systems and Tectonic Elements of the Colorado Plateau. University of New Mexico Publications in Geology, No. 6. Albuquerque.

Kent, Kate P.

1957 The Cultivation and Weaving of Cotton in the Prehistoric Southwestern United States. Transactions of the American Philosophical Society (n.s.), Vol. 47, Part 3.

Kessell, John L.

1979 Kiva, Cross, and Crown. U.S. Department of Interior, National Park Service, Washington, D.C.

Kewanwytewa, Jim

1957 A True Story. Plateau, Vol. 29, No. 4, pp. 87-88.

Kidder, Alfred V.

1932 The Artifacts of Pecos. Yale University Press, New Haven.

Kidder, Alfred V., and Samuel J. Guernsey

1919 Archeological Explorations in Northeastern Arizona. Bureau of American Ethnology Bulletin 65. Washington, D.C.

Kimball, Solon T., and John H. Provinse

1942 Navajo Social Organization in Land Use Planning. Applied Anthropology, Vol. 1, No. 4, pp. 18-25.

King, Dales S.

1949 Nalakihu: Excavations at Pueblo III Site on Wupatki National Monument, Arizona. Museum of Northern Arizona Bulletin, No. 23. Flagstaff.

King, Thomas F.

1978 The Archeological Survey: Methods and Uses. Cultural Resource Management Studies, Heritage Conservation and Recreation Service, U.S. Department of the Interior, Washington, D.C.

Kintigh, Keith W.

1985 Settlement, Subsistence, and Society in Late Zuni Prehistory.

Anthropological Papers of the University of Arizona, No. 44. Tucson.

Lamar, D. L.

1964 Geology of the Wupatki Blowhole System. Plateau, Vol. 37,No. 1, pp. 35-40.

Lamphere, Louise

1977 To Run After Them: Cultural and Social Bases of Cooperation in a Navajo Community. University of Arizona Press. Tucson.

Lang, Richard W., and Arthur H. Harris

1984 The Faunal Remains from Arroyo Hondo Pueblo, New Mexico: A Study in Short-term Subsistence Change. Arroyo Hondo Archeological Series, Vol. 5. School of American Research Press, Santa Fe.

Lange, Charles H.

1950 Notes on the Use of Turkeys by Pueblo Indians. El Palacio, Vol. 57, No. 7, pp. 204-209.

Larson, Daniel O., and Joel Michaelsen

1990 Impacts of Climatic Variability and Population Growth on Virgin Branch Anasazi Cultural Developments. American Antiquity, Vol. 55, No. 2, pp. 227-249.

Lewton, Frederick L.

1912 The Cotton of the Hopi Indians: A New Species of Gossypium. Smithsonian Miscellaneous Collections, Vol. 60, No. 6, pp. 1-10.

Lightfoot, Kent G.

1979 Food Redistribution Among Prehistoric Pueblo Groups. The Kiva, Vol. 44, No. 4, pp. 319-339.

1984 Prehistoric Political Dynamics: A Case Study from the American Southwest. Northern Illinois University Press, DeKalb, Illinois.

Lincoln, Edward P.

1961 A Comparative Study of Present and PastMammalian Fauna of the Sunset Crater and Wupatki Areas of Northern Arizona. Ms. thesis, University of Arizona.

Lindsay, Alexander J., Jr.

1961 The Beaver Creek Agricultural Community on the San Juan River, Utah. American Antiquity, Vol. 27, No. 2, pp. 174-187.

1970 A Descriptive Summary of Soil and Water Conservation Devices and Settlement Patterns in the Kayenta Anasazi Region. Paper presented at the Water Control Systems Symposium, Pecos Conference, Santa Fe.

Lipe, William D.

1974 A Conservation Model for American Archeology. The Kiva, Vol. 39, pp. 213-245.

Lowe, Charles H.

1964 The Vertebrates of Arizona. University of Arizona Press, Tucson.

Magers, Pamela C.

1975 The Cotton Industry at Antelope House. The Kiva, Vol. 41, No. 1, pp. 39-47.

Mangelsdorf, Paul C.

1958 Ancestor of Corn. Science, Vol. 128, November 28, pp. 1313-1319.

Marozas, Bryan A.

1984 The Use of Aerial Photography for the Discovery and Analysis of Prehistoric Agricultural Fields and Related Features at Wupatki National Monument, Arizona. M.A. thesis, Anthropology, Northern Arizona University, Flagstaff.

Martin Paul S., and Floyd W. Sharrock

1964 Pollen Analysis of Prehistoric Human Feces: A New Approach to Ethnobotany. American Antiquity, Vol. 30, No. 2, Part 1, pp. 168-180.

Martin, Paul S., and Fred Plog

1973 The Archaeology of Arizona: A Study of the Southwest Region. Doubleday/Natural History Press, Garden City, New Jersey.

Mason, Brian, and L. G. Berry

1968 Elements of Mineralogy. W. H. Freeman and Company, San Francisco.

Masse, W. Bruce

1979 An Intensive Survey of Prehistoric Dry Farming Systems Near Tumanmoc Hill in Tucson, Arizona. The Kiva, Vol. 45, No. 1, 2, pp. 141-186.

Maule, Stuart H.

1963 Corn Growing at Wupatki. Plateau, Vol. 36, No. 1, pp. 29-32.

McDougall, Walter B.

1962 Seed Plants of Wupatki and Sunset Crater National Monuments. Museum of Northern Arizona Bulletin, Flagstaff.

Mc.Gregor, John C.

1931 Prehistoric Cotton Fabrics of Arizona. Museum Notes, Vol. 4, No. 2, pp. 1-4.

1936 Dating the Eruption of Sunset Crater, Arizona. American Antiquity, Vol. 2, No. 1, pp. 15-26.

1941 Winona and Ridge Ruin, Part I: Architecture and Material Culture. Museum of Northern Arizona Bulletin, No. 18, Flagstaff.

1943 Burial of an Early American Magician. In Proceedings of the American Philosophical Society, Vol. 86, pp. 270-298. Philadelphia.

1951 The Cohonina Culture of Northwestern Arizona. University of Illinois Press, Urbana.

McKenna, Peter J.

1988 Citadel Testing, Material Culture. Report submitted to the National Park Service, Santa Fe.

McKusick, Charmion R.

1974 The Casas Grandes Avian Report. In Casas Grandes, A Fallen Trading Center of the Gran Chichimeca, Vol. 8. The Amerind Foundation, Dragoon and Northland Press, Flagstaff.

1981 The Faunal Remains of Las Humanas. In Contributions to Gran Quivira Archeology, compiled by Alden C. Hayes, pp. 39-65. National Park Service Publications in Archeology 17. Washington D. C.

1986 The Avian Remains. In Archeological Investigations At Antelope House. National Park Service, U.S. Department of Interior, Washington, D.C.

McNitt, Frank

1962 The Indian Traders. University of Oklahoma Press, Norman.

Meighan, C.W., D.M. Pendergast, B.K. Swartz, and M.D. Wissler

1959 Ecological Interpretation in Archaeology, Parts 1 and 2. American Antiquity, Vol. 24, No. 1, 1-23, and No. 2, 131-195.

Melnick, Robert Z.

1984 Cultural Landscapes: Rural Historic Districts in the National Park System. Park Historic Architecture Division, Cultural Resources Management, National Park Service, U.S. Department of the Interior, Washington, D.C.

Merrian, C. Hart

1890 Results of a Biological Survey of the San Francisco Mountains Region and Desert of the Little Colorado in Arizona. North American Fauna, Vol. 3, pp. 1-136.

Metzger, Todd R.

1989 Current Issues in Ruins Stabilization in the Southwestern United States. Southwestern Lore, Vol. 55, No. 3, pp. 1-11.

Miller, Alan H.

1962 Geological Investigations of the Wupatki Blowhole System. Ms. on file at Museum of Northern Arizona.

Mindeleff, Cosmos

1898 Navajo Houses. Annual Report of the Bureau of American Ethnology. U.S. Government Printing Office. Washington, D.C.

Mindeleff, Victor

1891 A Study of Pueblo Architecture: Tusayan and Cibola. Eighth Annual Report of the Bureau of Ethnology, pp. Vol. 3. Washington, D.C.

Minnis, Paul E.

1981 Seeds in Archaeological Sites: Sources and Some Interpretive Problems. American Antiquity, Vol. 46, No. 1, pp. 143-152.

1984 Native Food Plants of the American Southwest. Masterkey, Vol. 58, No. 1, pp. 3-8.

1985 Social Adaption to Food Stress: A Prehistoric Southwestern Example. University of Chicago Press, Chicago and London.

1986 personal communication.

Moore, Bruce M.

1975 Seasonal Farmhouse Architecture: An Alternative Perspective. ASA Newsletter, Archaeological Survey Association of Southern California, Vol. 22, No. 1, pp. 3-9.

1978 Are Pueblo Field Houses a Function of Urbanization? In Limited Activity and Occupation Sites: A Collection of ___ Conference Papers, ed. Albert E. Ward, pp. 9-16. Contributions to Anthropological Studies No. 1. Center for Anthropological Studies, Albuquerque.

Moore, Richard B., Edward W. Wolfe, and George E. Ulrich

1974 Geology of the Eastern and Northern Parts of the San Francisco Volcanic Field, Arizona. In Geology of Northern Arizona, Part II-Area Studies and Field Guides, Ed. by Thor N. V. Karlstrom, Gordon Swann, and Raymond L. Eastwood, pp. 465-494, Geological Society of America. Flagstaff.

Morgan, W. B.

1955 Farming Practice, Settlement Pattern and Population Density in Southeastern Nigeria. Geographical Journal, Vol. 121, pp. 320-333.

Morris, Don P.

1976 Earth Crack Archeology. In Wupatki National Monument Earth Cracks. Cave Research Foundation, Yellow Springs, Ohio.

Morris, Earl H., and Robert F. Burgh

1941 Anasazi Basketry: Basketmaker II through Pueblo III. Carnegie Institution of Washington, Publication 533. Washington, D. C.

National Park Service

n.d. Navajo Grazing Titles. Wupatki National Monument.

1982 Ethnohistoric Study for Navajo Culture. Development/Study Package Proposal, No. 137.

National Oceanic and Atmospheric Administration

1975 Climatography of the United States No. 20: Climate of Wupatki NM, Arizona. National Climatic Center, Asherville, N.C.

Nations, Dale, and Edmund Stump

1981 Geology of Arizona. Kendall/Hunt Publishing Company, Dubuque, Iowa.

Navajo Nation Historic Preservation Department

n.d. Navajo National Historic Preservation Pilot Project. Research funded by a grant from the Arizona State Historic Preservation Office. Field notes, on file, Window Rock, Arizona.

Nequatewa, Edmund

1946 How the Hopi Respect the Game Animals. Plateau, Vol. 18, No. 4, pp. 61-62.

Neusius, Sarah W.

1986 The Dolores Archaeological Program Faunal Data Base: Resource Availability and Resource Mix. In Dolores Archaeological Program: Final Synthetic Report, compiled by David A. Breternitz, Christine K. Robinson, and G. Timothy Gross. United States Department of the Interior, Bureau of Reclamation, Denver.

Nichols, Mary Jane

1939 Wupatki Wildlife. Southwestern Monuments Monthly Report, July, pp. 59-61.

Norusis, Marija J.

1988 SPSS/PC+ Advanced Statistics V2.0. SPSS, Chicago.

Olsen, Stanley J.

1967 Osteology of the Macaw and thick-billed Parrot. The Kiva, Vol. 32, No. 3, pp. 57-72.

1968 The Osteology of the Wild Turkey. Papers of the Peabody Museum of Archaeology and Ethnology. Vol. 56, No. 2. Harvard University, Cambridge.

1971 Zooarchaeology: Animal Bones in Archaeology and Their Interpretation. In A McCaleb Module in Anthropology. Addison-Wesley Publication Co., Phillippines.

1985 Origins of the Domestic Dog: The Fossil Record. University of Arizona Press, Tucson.

Parker, Kittie F.

1972 An Illustrated Guide to Arizona Weeds. University of Arizona Press, Tucson, Arizona.

Parry, Thomas E.

1981 Cultural Dynamics on a Prehistoric Frontier: A Study of Culturally Mixed Sites in Medicine Valley, Northern Arizona. M.S. thesis, Northern Arizona University, Flagstaff.

Peabody, Frank E.

1947 A Short History of Cheirotherium, the "Hand Animal" of the Triassic. Plateau, Vol. 20, No. 2, pp. 23-28.

Peshlakai, Clyde

1961 Affidavit as the Navajo Residence, Use and Occupancy of Certain Lands. U.S. Government document. Ms. on file, National Park Service, Santa Fe, New Mexico.

Peterson, Charles S.

1973 Take Up Your Mission: Mormon Colonizing Along the Little Colorado River, 1870-1900. University of Arizona Press.

Phillips, Allan R.

1947 Bird Life of the San Francisco Mountains. Hawks and Owls. Plateau, Vol. 20, No. 2, pp. 17-22.

1956 The Migrations of Birds in Northern Arizona. Plateau, Vol. 29, No. 2, pp. 31-35.

Pierce, Linda J.

1989 The Faunal Remains from Homolovi III. Ms. on file, Homolovi Research Program, Arizona State Museum, University of Arizona, Tucson.

Pilles, Peter J., Jr.

1969 Habitation and Field Houses Near Winona and Angell, Arizona. The Kiva, Vol. 34, No. 2, 3, pp. 90-102.

1974 Post Sunset Crater Eruption Developments in the Sinagua Culture: A Re-evaluation. Paper presented at the 39th Annual Meeting of the Society for American Archaeology, Washington, D.C.

1975 Petroglyphs of the Little Colorado River Valley, Arizona. In American Indian Rock Art, ed. Shari T. Grove, pp. 1-26. San Juan County Museum Association, Farmington, New Mexico.

1978 The Field House and Sinagua Demography. In Limited Activity and Occupation Sites: A Collection of Conference Papers, ed. by Albert E. Ward, Center for Anthropological Studies, pp. 119-133, Contributions to Anthropological Studies No. 1. Albuquerque.

1979 Sunset Crater and The Sinagua: A New Interpretation. In Volcanic Activity and Human Ecology, ed. by Payson D. Sheets and Donald K. Grayson, pp. 459-485, Academic Press. New York.

1981 The Southern Sinagua. Plateau, Vol. 53, No. 1, pp. 6-17.

1986 Personal Communication.

1987a The Sinagua: Ancient People of the Flagstaff Region. Exploration: Annual Bulletin of the School of American Research, pp. 2-12.

1987b Hisatsinom: The Ancient People of Sunset Crater. In Earth Fire: A Hopi Legend of the Sunset Crater Eruption, ed. Ekkerhart Malotki with Michael Lomatuwy'ma, pp. 105-119. Northland Press, Flagstaff.

Pinkley, Jean M.

1965 The Pueblos and the Turkey: Who Domesticated Whom. In Contributions of the Wetherill Mesa Archaeological Project, assembled by Douglas Osbourn, pp. 70-72. Society for American Archaeology, Memoir 19.

Plog, Fred

1979 Prehistory: Western Anasazi. In Handbook of North American Indians, Vol. 9, ed. by Alfonso Ortiz, pp. 108-130. Smithsonian Institution. Washington, D. C.

Plog, Fred T., and Cheryl K. Garrett

1972 Explaining Variability in Prehistoric Southwestern Water Control Systems. In Contemporary Archaeology: A Guide to Theory and Contributions, ed. by Mark P. Leone, pp. 280-288. Southern Illinois University Press, Carbondale.

Plog, Stephen

1980 Village Autonomy in the American Southwest: An Evaluation of the Evidence. In Models and Methods in Regional Exchange, ed. R. E. Fry, Society for American Archeology Papers, No. 1.

Plog, Stephen, Fred Plog, and Walter Wait

1978 Decision Making in Modern Surveys. In Advances in Archaeological Method and Theory, Vol. 1, Academic Press, New York.

Pomery, J. Anthony

1959 Hohokam Etched Shell, The Kiva, Vol. 24, No. 4, pp. 12-21.

Powell, John Wesley

1891 Explorations in Stone Villages. In Seventh Annual Report of the Bureau of American Ethnology, pp. 18-38. Washington, D.C.

Powell, Shirley, Peter P. Andrews, Deborah L. Nichols, and F. E.Smiley

1983 Fifteen Years on the Rock: Archaeological Research, Administration, and Compliance on Black Mesa, Arizona. American Antiqity, Vol. 48, pp. 228-252.

Prudden, T. Mitchell

1918 A Further Study of Prehistoric Small House Ruins in the San Juan Watershed. American Anthropological Association, Memoir 5, pp. 3-50.

Randall, Mark E.

1971 Early Marbles. Historical Archaeology, Vol. 5, No. 1, pp. 102-105.

Redman, Charles L.

1973 Multistage Fieldwork and Analytical Techniques. American Antiquity, Vol. 42, No. 4, pp. 61-79.

Reed, Erik K.

1951a Turkeys in Southwestern Archaeology. El Palacio, Vol. 58, No. 7, pp. 195-205.

1951b Types of Stone Axes in the Southwest. Southwestern Lore, Vol. 17, No. 3, pp. 45-51.

1956 Types of Village-Plan Layouts in the Southwest. In Prehistoric Settlement Patterns in the New World, ed. G. R. Willey, pp. 11-17. Viking Fund Publications in Anthropology No. 23. Wenner-Gren Foundation for Anthropological Research, New York.

Reed, Erik K., and James W. Brewer

1937 The Excavation of Room 7, Wupatki. Southwestern Monument Special Report, No. 13.

Renaud, Etienne B.

1948 Kokopelli: A Study in Pueblo Mythology. Southwestern Lore, Vol. 14, No. 2, pp. 25-40.

Richardson, Gladwell

1986 Navajo Traders. University of Arizona Press.

Ritterbush, Lauren

1984 Prehistoric Water Collection on Antelope Prairie, Wupatki National Monument. M.A. thesis, University of Kansas, Lawrence.

Robbins, Ethyl

1961 Affidavit as to Navajo Residence, Use and Occupancy of Certain Lands. U.S. Government document. Ms. on file, National Park Service, Santa Fe, New Mexico.

Roberts, Alexandra

n.d. An Ethnoarchaeological Investigation of Residential Site Reoccupation. Ph.D. dissertation prospectus. Ms. on file, University of New Mexico, Department of Anthropology.

1984 Archaeological Interpretation and the Role of Ethnographic Data. In Haliksa'i: UNM contributions to Anthropology, Vol. 3.

1986 Changes in Land Use among the Wupatki Navajos. In Coping Diversity: Diachronic Studies of Navajo Responses to Environmental, Social, and Economic Variability. Ed. Dana B. Oswald and Jeffrey S. Dean. Southern Illinois University Press. In preparation.

Robinson, W. J., B. G. Harrill, and R. L. Warren

1975 Tree-ring Dates from Arizona H-I, Flagstaff Area. Laboratory of Tree-ring Research, University of Arizona, Tucson.

Rohn, Arthur H.

1963 Prehistoric Soil and Water Conservation on Chapin Mesa, Southwestern Colorado. American Antiquity, Vol. 28, No. 4, pp. 441-455.

Rothrock, David P.

1976 Bluebird Water Controller. Manuscript submitted to Wupatki National Monument.

Ruppe, R. J.

1966 The Archeological Survey: A Defense. American Antiquity, Vol. 31, pp. 313-333.

Safford, William E.

1920 Daturas of the Old World and New: An Account of their Narcotic Properties and Their Use in Oracular and Initiary Ceremonies. In Smithsonian Institution Annual Report, pp. 537-567, Washington, D.C.

Sartor, J. Doyne

1964 Meteorological Investigations of the Wupatki Blowhole System. Plateau, Vol. 37, No. 1, pp. 26-34.

Sartor, J. Doyne, and Donald L. Lamar

1962 Meteorological-Geological Investigations of the Wupatki Blowhole System. Memorandum RM-3139-RC. Rand Corporation.

Scarborough, Vernon L.

1988 A Water Storage Adaptation in the American Southwest. Journal of Anthropological Research, Vol. 44, No. 1, pp. 21-40.

Schaafsma, Polly

1966 The Destruction and Preservation of Rock Paintings and Petroglyphs. El Palacio, Vol. 73, No. 1, pp. 27-31.

1967 A Survey of Tsegi Canyon Rock Art. Manuscript submitted to National Park Service, Santa Fe.

1975 The Horse in Rock Art. El Palacio, Vol. 81, No. 3, pp. 4-5.

1980 Indian Rock Art of the Southwest. School of American Research and the University of New Mexico Press, Albuquerque.

1985 Form, Content, and Function: Theory and Method in North American Rock Art Studues. In Advances in Archeological Method and Theory, Vol. 8, ed. Michael F. Schiffer, pp. 237-277. Academic Press, New York.

1987 Rock Art at Wupatki: Pots, Textiles, Glyphs. Exploration: Annual Bulletin of the School of American Research, pp. 20-27.

Schiffer, Michael B. and George J. Gummerman (editors)

1977 Conservation Archeology; A Guide for Cultural Resource Mangement Studies. Academic Press, New York. New York.

Schley, Robert A.

1961 Diurnal Air Flow through an Earth Crevice, Wupatki National Monument. Plateau, Vol. 33, No. 4, pp. 105-111.

1964 A Report on Archaeological, Geological, Meteorological and Speleological Investigations Made at the Wupatki National Monument, 1960-1963. Submitted to the National Park Service, Flagstaff.

Schroeder, Albert H.

1944 Facts and Comments: A Prehistoric Method of Collecting Water. American Antiquity, Vol. 9, No. 3, pp. 329-330.

1957 Area History Data. Memorandum to Superintendent, Wupatki National Monument. On file, Wupatki Grazing Files.

1977 Of Men and Volcanoes: The Sinagua of Northern Arizona. Southwest Parks and Monuments Association, Globe, Arizona.

Schurig, Rudolph G.

1971 Soil Survey. In Soil Survey and Range Site and Condition Inventory, Wupatki National Monument, Arizona. Report prepared by the Soil Conservation Service for the National Park Service.

Scott, Jane

1977 Research Report on Cultural Resources of Special Significance to Hopi People. Report submitted to the Southwest Cultural Resources Center, National Park Service, Santa Fe.

Seme, Michele

1984 The Effects of Agricultural Fields on Faunal Assemblage Variation. In Papers on the Archeology of Black Mesa, Arizona, Vol. II, ed. by Stephen Plog and Shirley Powell, pp. 139-157. Southern Illinois University Press, Carbondale.

Sharp, Robert P.

1941 Ancient Glaciers of the San Francisco Peaks. Plateau, Vol. 14, No. 2, pp. 28-32.

Shoemaker, Eugene M., and Duane E. Champion

1977 Eruption History of Sunset Crater, Arizona. Investigator's Annual Report, Wupatki-Sunset Crater National Monuments, Arizona. Report prepared for the National Park Service.

Smiley, Terah L.

1958 The Geology and Dating of Sunset Crater, Flagstaff, Arizona. In New Mexico Geological Society, Guidebook of the Black Mesa Basin, Northeastern Arizona, 9th Field Conference, pp. 186-190 ed. Roger T. Anderson and John W. Harshbarger.

Smith, Watson

1952 Excavations in Big Hawk Valley, Wupatki National Monument, Arizona. Museum of Northern Arizona Bulletin No. 24. Northern Arizona Society of Science and Art, Flagstaff.

n.d. One Man's Archaeology. Ms. in possession of the author.

1971 Painted Ceramics of the Western Mound at Awatovi. Papers of the Peabody Museum of American Archaeology and Ethnology, Vol. 38. Harvard University Press, Cambridge.

1985 Kishmus at Wupatki. The Journal of Arizona History, Vol. 6, No. 3, pp. 327-334.

SMMNR (Southwestern Monuments Monthly Narrative Reports)

1926-1941 Wupatki National Monument.

Snow, David H.

1973 Prehistoric Southwestern Turquoise Industry. El Palacio, Vol. 79, No. 1, pp. 33-51.

Snow, Joseph I.

1945 Trilobites of the Middle Permian Kaibab Formation of Northern Arizona. Plateau, Vol. 18, No. 2, pp. 17-24.

Soil Conservation Service

1983 Soil Survey of Coconino County Area, Arizona, Central Part. Compiled by Donald R. Taylor for the U.S. Department of Agriculture, Soil Conservation Service, in cooperation with the Arizona Agricultural Experiment Station.

Speth, John D., and Katherine Spielmann

1983 Energy Source, Protein Metabolism, and Hunter-Gather Subsistemce Strategies. Journal of Anthropological Archaeology, Vol. 2, pp. 1-31.

Sprague, Roderick, and Aldo Signori

1963 Inventory of Prehistoric Southwestern Copper Bells. The Kiva, Vol. 28, No. 4, pp. 1-20.

Stanislawski, Michael B.

1961 Two Prehistoric Shell Caches from Southern Arizona. The Kiva, Vol. 27, No. 2, pp. 22-27.

1963 Wupatki Pueblo: A Study in Cultural Fusion and Change in Sinagua and Hopi Prehistory. Ph.D. dissertation, University of Arizona.

Steckel, Carl F.

1987 Early Day Trader with the Navajos. Privately printed.

Steen, Charlie R.

1949 Archeological Survey, Citadel District. In Nalakihu: Excavations at a Pueblo III Site on Wupatki National Monument, Arizona, Museum of Northern Arizona Bulletin, No. 23. Flagstaff.

Stevenson, Matilda C.

1915 Ethnobotany of the Zuni Indians. In The Thirtieth Annual Report of the Bureau of American Ethnology (1908-1909), pp. 31-102. Washington, D.C.

Stewart, Frances L., and Peter W. Stahl

1977 Cautionary Note on Edible Meat Poundage Figures. American Antiquity, Vol. 42, No. 2, pp. 267-270.

Stewart, Guy R., and Maurice Donnelly

1943 Soil and Water Economy in the Pueblo Southwest. Scientific Monthly, Vol. 56, No. 1, 2, pp. 31-44.

Stewart, J. H., F. G. Poole, and R. F. Wilson

1972 Stratigraphy and Origin of the Triassic Moenkopi Formation and Related Strata in the Colorado Plateau Region. Geological Survey Profesional Paper 691. Washington, D.C.

Stewart, Yvonne G.

1980 An Archeological Overview of Petrified Forest National Park. Western Archeological Center, Tucson, Publications in Anthropology Center, No. 10.

Stiger, Mark A.

1979 Mesa Verde Subsistence Patterns from Basketmaker to Pueblo III. The Kiva, Vol. 44, Nos. 2-3, pp. 133-144.

Stilgoe, John R.

1982 Common Landscape of America, 1580-1845. Yale University Press, New Haven.

Stokes, M. A., and T. L. Smiley

1964 Tree Ring Dates from the Navajo Land Claim: II. The Western Sector. Tree Ring Bulletin, Vol. 26, No. 1-4, pp. 13-17. Tucson.

Stuart, David R.

1978 Recording Southwestern Rock Art Sites. The Kiva, Vol. 43, No. 3, 4, pp. 183-199.

Sullivan, Alan P., III

1986 AZ I:1:17 (ASM) -- Occupational Dynamics of a Small Kayenta Anasazi Settlement. In Prehistory of the Upper Basin Coconino County Arizona, by Alan P. Sullivan, III, pp. 47-190. Arizona State Museum Archaeological Series No. 167. Arizona State Museum, Univeristy of Arizona, Tucson.

Sullivan, Alan P. III, and Kenneth C. Rozen

1985 Debitage Analysis and Archaeological Interpretation. American Antiquity, Vol. 50, No. 4, pp. 755-779.

Sutton, Mark Q.

1977 The Archeological Concept of Field House. M.A. thesis, California State University, Sacramento.

Swartz, B. K., Jr.

1981 Standards for the Recording of Petroglyphs and Pictographs. Current Anthropology, Vol. 229, No. 1, pp. 94-95.

Sweet, Muriel

1976 Common Edible and Useful Plants of the West. Naturgraph Publishers, Happy Camp, California.

Szuter, Christine R.

in press The Faunal Remains from Homolovi II. In Homolovi II: Recent Research on an Ancestral Hopi Village in Northeastern Arizona, ed. by E. Charles Adams and Kelly A. Hays, Anthropology Papers. University of Arizona, Tucson.

Titiev, Mischa

1944 Old Oraibi: A Study of the Hopi Indians of Third Mesa. Papers of the Peabody Museum of American Archaeology and Ethnology, Vol. 22, No. 1. Harvard University, Cambridge.

Toulouse, Carmie Lynn

1975 Notes on the Summer Migration of Eastern Reservation Navajos. In Collected Papers in Honor of Florence Hawley Ellis. Anthropological Papers of the Archaeological Society of New Mexico 2.

Toulouse, Julian H.

1971 Bottle Makers and their Marks. Thomas Nelson, New York.

Tower, Donald B.

1945 The Use of Marine Mollusca and Their Value in Reconstructing Prehistoric Trade Routes in the American Southwest. Papers of the Excavators Club, Vol. 2, No. 3. Cambridge.

Trimble, Marshall

1982 CO Bar: Bill Owens Depicts the Historic Babbitt Ranch. Northland Press, Flagstaff. Arizona.

Turner, Christy G., II

1963 Petrographs of the Glen Canyon Region. Museum of Northern Arizona Bulletin 38. Glen Canyon Series, No. 4. Flagstaff.

Turney, William F.

1985 Prehistoric Water Reservoirs -- The Southwest. Papers of Archaeological Society of New Mexico, No. 10.

Upham, Steadmanl, Kent G. Lightfoot, and Roberta A. Jewett

1989 The Sociopolitical Structure of Prehistoric Southwestern Societies. Westview Press, Boulder.

Urban, Sharon

1984 Homolovi Shell. In Excavation and Surface Collection of Homolovi II Ruin, compiled by Kelly A. Hays, Rich C. Lang, and J. H. Madsen. M.S. in the Arizona State Museum Library, Tucson.

U.S. Commissioner of Indian Affairs

1857-
1911 Annual Report of the Commissioner of Indian Affairs. U.S. Government Printing Office, Washington, D.C.

VanCleve, Phillip F.

n.d. Correspondence and geneological data, in possession of the author. Carlsbad, New Mexico.

Van Valkenburgh, Richard

1941 Dine Bikeyah. United States Department of the Interior, Office of Indian Affairs. Window Rock, Arizona.

1947a We Saw the Devil Chant of the Navajo. Desert Magazine.

1947b Don't Knock on a Hogan Door. Desert Magazine. Vol. 10, No. 12.

Van Valkenburgh, Sallie

1961a Artifacts from Gran Quivira. In Gran Quivira: Excavations in a 17th Century Jumano Pueblo, compiled by Gordon Vivian, pp. 124-139. National Park Service Research Series No. 8. Washington, D. C.

1961b Archaeological Site Survey at Walnut Canyon National Monument. Plateau, Vol. 34, No. 1, pp. 3-17.

Vander Ven, William

1977 Petroglyphs Located within the Citadel Group, Wupatki National Monument, Arizona. Paper submitted to San Francisco State University, San Francisco.

Van Devender, Thomas R., and W. Geoffrey Spaulding

1979 Development of Vegetation and Climate in the Southwestern United States. Science, Vol. 204, May 18, pp. 701-710.

Vanderhoof, V. L.

1934 The Chinle Formation. Museum Notes, Vol. 6, No. 7, pp. 35-38.

Vivian, Gordon

1960 May 31st Memorandum to Regional Chief of Interpretation discussing a comparative shell collection.

1956 Alcove House at N.A. 5700. Plateau, Vol. 29, No. 1, pp. 6-11.

Vivian, R. Gwinn

1974 Conservation and Diversion: Water Control Systems in the Anasazi Southwest. In Irrigations Impact on Society, ed. Theodore Downing and McGuire Gibson. Anthropological Papers of the University of Arizona 25. Tucson.

Ward, Albert E.

1978 Sinagua Farmers before the "Black Sand" Fell: An Example from Wupatki National Monument. In Limited Activity and Occupation Sites: A Collection of Conference Papers, ed. Albert E. Ward, pp. 135-146. Contributions to Anthropological Studies, No. 1. Center for Anthropological Studies, Albuquerque.

Ward, Albert E., Emily K. Abbink, and John R. Stein

1977

Ethnohistorical and Chronological Basis of the Navajo Material Culture. In Settlement and Subsistence Along the Lower Chaco River: The CGP Survey, ed. Charles A. Reher. University of New Mexico Press, Albuquerque.

Warren, Claude N.

1980 Pinto Points and Problems in Mojave Desert Archaeology. In Anthropological papers in Memory of Earl H. Swanson, Jr., ed. L. B. Harten, C. N. Warren, and Dr. Tuohy, pp. 67-76. Special Publication of the Idaho Museum of National History. Pocatello, Idaho.

Watson, Editha L.

1964 Navajo Sacred Places. Navajoland Publications, Series 5. Navajo Tribal Museum, Window Rock, Arizona.

Weber, Steven A.

1981 A Palynological Interpretation of the Sinagua and Their Changing Environment. M.A. thesis, Anthropology, Northern Arizona University, Flagstaff.

Weldon, Amy

1979 The Navajos of Wupatki Basin: A Geneology and Historical Sketch. MS. on file, Wupatki National Monument.

Weltfish, Gene

1932 Preliminary Classification of Prehistoric Southwestern Basketry. Smithsonian Miscellaneous Collections, Vol. 87, No. 7. Washington, D. C.

Wetterstrom, Wilma

1986 Food, Diet, and Population at Prehistoric Arroyo Hondo Pueblo, New Mexico. Arroyo Hondo Archeological Series, Vol. 6, School of American Research Press, Santa Fe.

White, Theodore E.

1952 Observations on the Butchering Technique of Some Aboriginal Peoples: American Antiquity, Vol. 17, No.4, pp. 337-338.

1953a Observations on the Butchering Technique of Some Aboriginal Peoples: American Antiquity, Vol. 19, No. 2, pp. 160-164.

1953b A Method of Calculating the Dietary Percentage of Various Food Animals Utilized by Aboriginal Peoples. American Antiquity, Vol. 18, No. 4, pp. 396-398.

1955 Observations on the Butchering Techniques of Some Aboriginal Peoples. American Antiquity, Vol. 21, No. 2, pp. 170-178.

Whiteford, Andrew

1986 personal communication.

Whiting, Alfred F.

1939 Ethnobotany of the Hopi. Museum of Northern Arizona Bulletin, No. 15.

Wilcox, David R.

1978 The Theoretical Significance of Field Houses. In Limited Activity and Occupation Sites: A Collection of Conference Papers, ed. Albert E. Ward, pp. 25-32. Contributions to Anthropological Studies No. 1. Center for Anthropological Studies, Albuquerque.

1986 Excavations of Three Sites on Bottomless Pits Mesa, Flagstaff, Arizona. Interim Report. Ms. on file, Museum of Northern Arizona, Flagstaff.

Wills, W. H.

1989 Patterns of Prehistoric Food Production in West-Central New Mexico. Journal of Anthropological Research, Vol. 45, No. 1, pp. 139-157.

Wilmsen, Edwin, and Frank H. Roberts

1978 Lindenmeier, 1934-1974: Concluding Report on Investigations. Smithsonian Institution Press, Washington, D.C.

Wilson, John P.

1969 The Sinagua and Their Neighbors. Ph.D. dissertation, Department of Anthropology, Harvard University, Cambridge.

Wing, Elizabeth S., and Antoinette B. Brown

1979 Paleonutrition: Method and Theory in Prehistoric Foodways. Academic Press, New York.

Winter, Joseph C.

1978 Anasazi Agriculture at Hovenweep. I: Field Systems. In Limited Activity and Occupation Sites, ed. Albert E. Ward, pp. 83-97. Contributions to Antrhropological Studies No. 1. Center for Anthropological Studies, Albuquerque.

Womack, Bruce Raymond

1977 An Archaeological Investigation and Technological Analysis of the Stockhoff Basalt Quarry, Northeastern Oregon. Master's thesis, Washington State University, Pullman.

Woodbury, Richard B.

1954 Prehistoric Stone Implements of Northeastern Arizona. Papers of the Peabody Museum of American Archaeology and Ethnology, Vol. 34. Harvard University, Cambridge.

1961 Prehistoric Agriculture at Point of Pines, Arizona. Memoirs of the Society for American Archaeology 17. Salt Lake City.

Woodward, Arthur

1936 A Shell Bracelet Manufactory. American Antiquity, Vol. 2, No. 2, pp. 117-125.

1946 A History of Navajo Silversmithing. Second edition. Museum of Northern Arizona, Bulletin 14.

Woosley, Anne I.

1980 Agricultural Diversity in the Prehistoric Southwest. The Kiva, Vol. 45, No. 4, pp. 317-335.

Wormington, H. Marie

1951 Prehistoric Indians of the Southwest. Denver Museum of Natural History, Popular Series 4. Denver.

Wupatki National Monument Records

1986 Precipitation Records for 1951-1985. Record maintained at the Visitor Center, Flagstaff.

Yarnell, Richard A.

1959 Prehistoric Pueblo of Datura. El Palacio, Vol. 66, No. 5, pp. 176-178.

1965 Implications of Distinctive Flora on Pueblo Ruins. American Anthropologist, Vol. 67, No. 3, pp. 662-674.

1977 Native Plant Husbandry North of Mexico. In Origins of Agriculture, ed. Charles A. Reed, pp. 862-875. Mouton, The Hague.

Young, Gwen

1980 Analysis of Faunal Remains. In Tijeras Canyon: Analysis of the Past, ed. Linda S. Cordell, pp. 88-120. Maxwell Museum of Anthropology and the University of New Mexico Press.

Young, Robert W.

1978 A Political History of the Navajo Tribe. Navajo Community College Press, Tsalie, Arizona.

York, Fredrick F.

1983 Navajo Settlement and Subsistence within the Last Century. In Economy and Interaction Along the Lower Chaco River, ed. by Patrick Hogan and Joseph C.Winter. Office of Contract Archaeology and Maxwell Museum of Anthropology, University of New Mexico, Albuquerque.

Yudkin, John

1969 Archaeology and the Nutritionist. In The Domestication and Exploitation of Plants and Animals, ed. Peter J. Ucko and G. W. Dimbleby, pp. 547-552. Aldine Press, New York.

Zunie, Jerome

1989 Faunal Remains at WS-1432. In NAU-Summer Field School Student Papers from Archaeological Investigations at Wupatki National Monument, Summer, 1989, compiled by David P. Braun, Manuscript on file at Wupatki National Monument.

Newspaper Articles

Arizona Daily Sun

September 5, 1947.

County Resident 100 Years Dies: Grandmother Peshlakai Passes On.

December 15, 1970.

Navajos Plead for Homes.

Arizona Republic

December 16, 1970.

Navajos Ask Return to Monument Lands.

Phoenix Gazette

March 28, 1980.

Old Time Range War Target of Indian Suit.

☆U.S. GOVERNMENT PRINTING OFFICE: 1990 776-935/25178